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The Monthly Review

Published by the AMERICAN ELECTROPLATERS' SOCIETY

NOVEMBER 1938

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The Monthly Review

Published by the AMERICAN ELECTROPLATERS' SOCIETY, Inc.

A Society for the Advancement of the Science of Electroplating

NOVEMBER 1938

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The Monthly Review

Published by the
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VOL. XXV NOVEMBER 1938 NO. 11

Editorial

The following announcement has been made by Baltimore-Washington Branch and should receive every consideration by the other Branches.

It was regularly moved and passed that any member presenting a paper which is approved by the Branch Committee, and accepted by the Convention committee on papers will be given thirty-five ($35) dollars to pay their expenses to attend the convention at Asbury Park in June, 1939.

For further information consult the Branch Committee:—Dr. Wm. Blum, Mr. Thomas F. Slattery, Mr. Fred F. Pierdon.

Suggestions:

Short papers on practical application of electroplating and finishing of metals or technical research.

In a letter recently sent to all Branches by the Chairman of the Educational Committee of the 1939 Convention, Mr. George B. Hogaboom, the request was made that the Branches follow the custom of the past two years, of preparing papers on subjects of interest to platers at the Educational Session of the next Convention.

It is not too early to make plans for presenting such papers. Being human, we believe in procrastination to such an extent that many of us hear these appeals read by the Branch Secretaries and forget about them until a month or two before the Convention, then we start to hustle.

Work of this nature requires lots of time for preparation. We are therefore, asking our members to decide at once whether or not the Branch will present a paper this year, and if so, notify their chairman of the Educational Committee of their decision, giving him if possible, the name of the subject to be presented at the Convention. The next step will be to discuss the topic at all branch meetings, getting data from each member and taking notes of the same. A committee can then be appointed to write the paper so that it will be easily understood, using the information already received at preceding meetings. Read the paper at your own Branch meeting a month or so before the Convention, have it criticized, then add or subtract from the suggestions received. The person reading the paper will then be perfectly familiar with the subject and can easily answer questions during the discussion period.

This method has been adopted in several branches and has

proved successful. Incidentally, it has been a distinct help in creating interest among the members most of whom will have a share in small or large measure in the preparation of the paper.

We are asking our readers again to heed the announcement of the Baltimore-Washington Branch and to inform the committee as to the intention of your Branch regarding papers for the 1939 Convention. Answers to Mr. Hogaboom's letter should also be sent in without delay.

We have a message from Mr. George Wagner, Secretary of Newark Branch, regarding exhibits, which is also of interest, and commands attention. Mr. Wagner writes:—

PLATED WARE EXHIBIT—Conventions. Article V, Section 2b page 14 (1938 Revision). Purpose, Exhibiting anything that relates to the Electro-deposition of metals.

The above is taken from the by-laws and is sufficient reason to make known at this time the dire need of assistance from all parties concerned to make the PLATED WARE EXHIBIT at the Convention a successful and an outstanding one.

Success can not be attained by mere words, for the successful termination of any enterprise is accomplished by considerable thoughtful planning and above all, keen co-operation from the members of the society to take part in the coming PLATED WARE EXHIBIT at Asbury Park.

Those of you who were at the Milwaukee Convention will recall the wide interest shown in the Platers' Exhibit. It surely created high praise. A job well done by the committee, yes, and those who contributed the displays certainly were pleased with the interest their individual EXHIBITS excited.

The science of the electro-deposition of metals is a broad one and of intense interest. New solutions and new methods are being constantly developed, and with the aid of the skilful electroplater lending instruction to the design and wheel effects on the articles manufactured, finishes are produced that are both decorative and protective. Products finished in such a routine deserve to be displayed at the PLATED WARE EXHIBIT and the electroplater should be proud to make this display.

An open invitation is extended to electroplaters, manufacturers and hobbyists interested in electroplating to participate in a display at the INTERNATIONAL Convention, Asbury Park, N. J. PLATED WARE EXHIBIT. Remember the EXHIBIT will play a great part in the success of the INTERNATIONAL CONVENTION. Begin planning your EXHIBIT NOW! Show the other fellow what you are doing.

THE PLATED WARE EXHIBIT COMMITTEE.

Both the Branch papers and exhibits promise to be lively topics from now until we meet again at Asbury Park, June 19-22, 1939.

WANTED

ATTENDANCE TO THE

"INTERNATIONAL CONVENTION"

(NEWARK BRANCH A. E. S.)

AT ASBURY PARK, N. J.

June 19th, 20th, 21st, 22nd

1939

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November 1, 1938

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Cleveland	9	
Philadelphia	9	1
New Haven	8	
Toronto	7	1
San Francisco	6	
Dayton	5	1
Binghamton-Syracuse	2	
Boston	2	
Milwaukee	2	
New York	2	2
Rochester	2	
Springfield	2	
Anderson	1	
Bridgeport	1	
Cincinnati	1	
Los Angeles	1	
Pittsburgh	1	1
St. Louis	1	
Newark		1
Providence-Attleboro.		1
Baltimore-Washington		
Buffalo		
Hartford		
Montreal		
Toledo		
Waterbury		

The Value *of* Electroplating Researches *to the* Manufacturing Industry*

By WILLIAM BLUM

Bureau of Standards, Washington, D. C.

I. INTRODUCTION

THE purpose of this address is to summarize some of the advances made in the electroplating industry through research, especially during the last decade, and to indicate the directions in which further progress may be expected. The examples of persons, institutions and processes that are cited are intended only as illustrations, and are neither inclusive or exclusive. Any comprehensive report would involve a critical analysis of the more than five hundred important papers on electrodeposition that have appeared during the last ten years, not to mention a probably larger number of patents.

II. TYPES OF RESEARCH

The term research has acquired many meanings, some of which are misleading and others are mysterious or vague. For present purposes we may define research as "a systematic experimental effort to increase existing knowledge in a specified field in order to accomplish some useful purpose." "Theorizing" does not constitute research, though it may become an important part, provided that its conclusions are subjected to the test of experiment. The term "useful" is employed in a broad sense, and is not confined to immediate utility.

Three fairly distinct applications of science are involved to some extent in every successful industrial development, though they may not occur in that order.

(1) The general principles of the process must be understood, either explicitly or implicitly. (2) Their possible applications in accomplishing some useful purpose must be investigated. (3)

*Publication Approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

The procedures and equipment required to carry out such processes efficiently and economically must be developed. These three steps involve (1) fundamental research, (2) industrial research, and (3) engineering (which latter often involves research).

In electroplating, there is a need for increased knowledge in all three of these fields. The fundamental principles of electrodeposition are not clearly understood, and will not be until more is learned of the constitution of matter, including both the electrolytes and the deposits, and the changes brought about by electrolysis. The nature of polarization, overvoltage, passivity, and corrosion are closely associated with the processes of plating and the behaviour of the coatings. The progress that will ultimately be made in new problems of plating, say twenty-five years from now, will depend very directly on the progress made in general electrochemistry, including the application of the modern theories of both physics and chemistry. "The fountain can rise no higher than its source."

Most of the studies conducted on plating come within the field of industrial research, and have for their object (1) the improvement or standardization of existing processes; (2) the development of new processes, or (3) the specification and testing of the plated products. The choice between the first two aims is often difficult. It is practically certain that any process that has been in operation ten years or more, especially in the hands of "practical men", can be materially improved by standardization and control. Even if such efforts result merely in producing consistently products of a quality equal to the best that were produced only occasionally before, a great advance has been made. On the other hand, development of entirely new procedures is sometimes necessary to meet new needs and to successfully compete with other processes and products.

The demand for specifications and tests of quality comes, even though at times very indirectly, from the ultimate consumer, who is becoming more concerned with quality marks than with trademarks. More extensive application and recognition of standards of quality for plating will help every reliable manu-

facturer, and will discourage poor workmanship and unfair competition.

The last decade has seen a large increase in the application of engineering principles to electroplating problems. So long as the electroplating industry, and especially the average unit, was small, there was little opportunity for engineering, except that based on common-sense and experience. But with the advent of large plating installations and new procedures, there is a demand, which is being met, for more intelligent selection of materials of construction, and for more efficient electrical and mechanical devices, including large "full automatic" equipment.

III. BY WHOM SHOULD THE RESEARCH BE CONDUCTED?

1. Industrial Laboratories. As electroplating is an industry and constitutes an essential, though at times minor, part of many larger industries, the first thought is that such research should be conducted in the laboratories of those companies that either (a) supply the materials and apparatus for plating, (b) are engaged in plating operations, or (c) are large consumers of plated products. Actually, a large amount of plating research is being conducted in all three types of industrial laboratories, only a part of which is published. One serious limitation of such researches is that consideration of patents or of competition often prevents or delays publication of the results. Ultimately, the useful results become known and available, but such delays should be curtailed as much as equity permits. In some cases, firms have found that the reputation and good-will secured through early publication more than compensate for any reduction in direct royalties. Among the large companies that have conducted researches on plating and have published the results are the General Motors Corporation, the Westinghouse Manufacturing Company, the General Electric Co., the Hanson-Van Winkle-Munning Co., the Bell Telephone Co., the Dupont Company, the New Jersey Zinc Co., and the International Nickel Company.

Another drawback to researches by companies, especially by those interested in the licensing of a process or the sale of an essential material, is the natural fear that the published results

may be biased, in either their inclusions or omissions. Such a fear is inherent and is not based on lack of confidence in the integrity of the firm. Recognition of this fact causes many large producers to support or co-operate in researches in public or quasi-public institutions, where all question of bias is removed.

One obstacle to extensive research in industrial laboratories is the fact that, if the research personnel are also connected with plant operation, trouble in the latter, or the advent of new problems, causes termination or interruption of the original program. Hence the work accomplished, even though perhaps adequate to meet some immediate need of that firm, is not sufficiently complete or conclusive to warrant publication. This situation is less likely to develop if a separate research laboratory and staff are maintained, although even such a staff is at times drafted for "trouble shooting".

Studies of specific applications and products, and especially of the efficiency and economy of alternate procedures, must usually be conducted in or for the plant concerned, where certain conditions or requirements may be unusual, or even unique. Such plant studies will, however, be greatly facilitated by the data acquired in more general investigations.

2. University Laboratories. In recent years, studies on plating problems have been made in numerous educational institutions. Comparatively few of these have extensive electrochemical laboratories or staffs, and hence the activity usually centers in some professor who is especially interested. His interest gives continuity to the studies, which, however, are largely conducted by a series of graduate students, each of whom works for one academic year upon some phase of the problem. Of course, when work in universities is subsidized by some company or association, full-time employees may be engaged for any desired period, with a corresponding gain in productivity. Among those most active in research in American schools are C. G. Fink, Columbia University; E. M. Baker and H. H. Willard, University of Michigan; O. P. Watts, University of Wisconsin; F. C. Mathers, University of Indiana; and L. E. Stout, Washington University. In colleges abroad, researches of special interest to platers have been conducted by S. Glasstone in Sheffield; P.

Jacquet in Paris; E. Mantzell in Stuttgart; V. Kohlschütter in Bern; Erich Müller in Dresden; A. Glazunov in Pribram; and J. Billiter in Vienna. One of the great advantages of such researches is that they serve to interest in electrodeposition a number of students who later become active in other institutions or laboratories.

3. Research Institutes. In recent years several endowed institutions have been founded for research in specified fields. These have the advantage over schools that they can employ full-time staffs for research and can provide more adequate equipment than is usually available in colleges. They are more free than Government institutions to patent the results and thus reserve them for the co-operating firms or organizations. Among those of special interest to platers are the Mellon Institute, where H. Work studied methods of plating on aluminum; and Battelle Institute, where C. L. Faust is investigating alloy deposition.

4. Government Laboratories. The principal Federal Laboratory engaged in electroplating researches is the National Bureau of Standards. This institution has several points of contact with the electroplating industry. (1) Many Government agencies, including especially the War, Navy, and Treasury Departments, conduct plating operations, in some cases for highly specialized purposes. This Bureau is frequently called upon for advice and assistance in the development of methods and equipment for these plants. (2) The Federal Government is a large purchaser of plated materials, including plumbing fixtures, hardware, tableware, and electrical conduit and fittings; for which specifications must be prepared and deliveries tested. (3) The Federal Trade Commission and the Treasury Department frequently request advice regarding the definition or quality of plated articles involved in cases before these agencies. (4) Many requests for impartial information about plating processes or products are received from persons, firms, and organizations.

In order to meet the above demands, it is necessary for the Bureau to maintain a staff of qualified persons, and to have

equipment and facilities for research on the numerous problems of plating. Except in unusual cases, the results of such studies are made available to the public through appropriate publications, especially in the National Bureau of Standards Journal of Research. Nearly 100 papers on electrodeposition have been published from this Bureau in this and other journals.

In order to facilitate the co-operation of the Bureau with organizations that desire to extend the scientific knowledge in their fields, the "Research Associate" plan has been organized. In this arrangement, the co-operating society pays the salary and other expenses of a qualified investigator, who works upon a selected problem at the Bureau, by whom space, facilities, supplies, supervision, and technical and clerical assistance are supplied. The results of such joint investigations are fully published and are available for use by everybody. At present about 20 organizations are engaged in these co-operative researches, on which about 55 Research Associates are employed at the Bureau.

This plan is well illustrated by the program on the protective value of plated metals that is now being conducted by co-operation of the American Electroplaters' Society (composed chiefly of foreman platers), the American Society for Testing Materials and the National Bureau of Standards. The Electroplaters' Society collects its Research Fund through annual contributions from its members or Branches and from a large number of firms. From this fund is paid the salary of their Research Associate, at present P. W. C. Strausser. In addition, many manufacturers have donated metals, plating supplies, and equipment for use in preparing the required specimens at the Bureau. The American Society for Testing Materials, through its committees, furnishes space and equipment for conducting outdoor exposure tests, and co-operates in the inspections and in the interpretation of results and their application in specifications. The details of the program are arranged by a Joint Committee that represents the three agencies.

Previous researches conducted by the Electroplaters' Society and the Bureau were devoted to "spotting out", the "throwing

power of chromium solutions" and the "porosity of chromium deposits".

At the Woolwich Arsenal, in England, a somewhat parallel arrangement has proved successful. In addition to those members of the staff who are engaged on problems of special interest to the government, several are employed on funds furnished in part by the British Non-Ferrous Metals Research Association and the International Tin Research and Development Council. In the past several years extensive investigations, especially of nickel and tin deposition, have been conducted through this co-operation, and valuable papers have been published.

IV. THE COST AND VALUE OF RESEARCH

The questions may well be asked regarding each of these types of research (1) who pays for them, and (2) who benefits by them? In a very real sense, it is the general public which pays, even though indirectly, for all costs of manufactured products, and which benefits by any improvement in quality or reduction in cost that may be effected through research. But such an interest, however real, is too remote, especially in an industry like plating, which is almost always an incidental step in some larger industry. Both the demand for and support of industrial research on plating must therefore come from those persons who are in charge of plating, or from those firms that conduct plating processes or use plated products. Co-operation with technical societies usually furnishes the most economical means for obtaining information that is of interest to the whole industry, because in only a few plants is plating conducted on a sufficiently large scale to warrant the cost of any extensive company research.

The possible applications of the results may be illustrated by the outdoor exposure tests that lead to the tentative specifications for plating iron and steel, that were adopted in 1935 by the American Electroplaters' Society and the American Society for Testing Materials. Consumer agencies, including the Government, are in a favorable position to incorporate these conclusions in their purchase specifications. The manufacturer

who desires to bid on these products will (if he is wise) first satisfy himself that he can meet the requirements at a reasonable cost. The plater, who is in actual charge of the process, must so control all factors that the products have the required thickness and quality of coatings. In a large plant, the plater will depend upon the chemist to test the deposits in advance instead of "hoping" that they will meet the tests made by the consumer. The chemist may also be called upon to control or improve the composition of the baths to insure a uniformly high quality. Especially in the design of a new plant, the engineer must select equipment that will function efficiently and economically for the cycle selected. The accounting and estimating department must know how much it costs to manufacture products of the specified quality.

In a very real sense, each of these persons is applying the results of some research, of which he may never have heard. But unless there is this varied but continuous use of the results of research, it is of little value. Publications do not produce dividends. Hard work is also required.

It is difficult, and may be dangerous, to attempt to estimate the actual value of any particular research. Purely for illustration, a few conservative "guesses" may be made regarding the exposure tests of plated steel, conducted from 1931 to 1935. The total amount paid out from the American Electroplaters' Society Research Fund was about $20,000, and an equal sum was expended by the Bureau of Standards. Donated supplies represented about $5000 and the cost of travel of various persons for inspections may have been $5000. The research therefore cost a total of about $50,000 during the five-year period.

Whether it was worth this sum depends both on the potential value of the results and the extent of their practical application. As the net conclusion represented an increase in the thickness of plating, the manufacturers, for example of automobiles, may have had to increase their cost of plating. Actually, however, the increased thickness gave them a greater incentive to make their plating processes more efficient. Since most of them have adopted these (or even more severe) specifications,

it is safe to assume that they believe that they have thereby improved the quality of their plating. Moreover, they have successfully met the competition of stainless steel, the extensive application of which would almost certainly be more costly than the improved plating. The present practice rests largely upon research and experience of the individual firms, but the joint exposure tests served to confirm and crystallize their conclusions.

How much did this particular research cost the public? If we assume that it was applied, directly or indirectly, to only one million automobiles, each of the purchasers (or some one else) paid 5 cents per car for this research. Few persons will question that the improvement in plating on automobiles in recent years brought about by this and other researches, is equivalent to many times that figure.

V. EXAMPLES OF RESEARCH IN PLATING

1. Tests and Specifications. Analysis of papers published in the last decade indicates that more studies have been conducted upon specifications and methods of test than on any other single phase of plating. Notable results are (1) the "dropping test" for zinc and cadmium, devised by Clarke in England and modified by Hull and Strausser; (2) the "N.B.F. jet test", especially for nickel coatings, also devised by Clarke; (3) the "chord method" of Mesle; and (4) the magnetic test of Brenner. Extensive studies were also conducted recently by Bauer, Arndt and Kraus in Berlin upon methods of testing plated coatings on automobiles. The results of exposure tests and laboratory tests of nickel, chromium, zinc, and cadmium coatings on steel were published by Strausser and his associates at the Bureau of Standards. As above mentioned, tentative specifications were adopted by the A.E.S. and A.S.T.M., and methods of test will soon be incorporated. Outdoor exposure tests are now in progress upon plated brass and zinc-base die castings.

2. Structure and Distribution of Deposits. That research on fundamentals has not been neglected is indicated by the publication of over 35 papers on the structure of electrodeposits, including those of Cymboliste and Jacquet in France; of Finch,

Hunt, Macnaughtan and Hothersall in England; of Foerster and Schloetter in Germany; and of Meyer, Clark, Graham, Blum, and Rawdon in America.

The throwing power of plating solutions is especially important in connection with the plating of articles to meet a specification for minimum thickness. About 25 papers have appeared on this subject since the early work of Haring in this country. Many of these involve different empirical devices for measuring throwing power, or equations for expressing this property.

The importance of acidity or pH measurements in nickel baths is generally recognized. Only recently, through the work of Springer, in Germany, and of Hogaboom in America, has the possible importance of pH measurements in alkaline cyanide solutions been emphasized.

3. Specific Metals. Over 50 papers have appeared on nickel deposition, through which a better understanding of the operation and control of the baths is now possible. Much study of "bright nickel" plating is in progress, but not many results have yet been published. (Bright nickel deposits, which require no buffing, are now very extensively applied prior to chromium plating.) Chromium plating accounts for about 50 papers, though no radical changes in bath composition have been adopted. Zinc and cadmium plating have both received study, especially the production of bright coatings. There has been considerable activity on rhodium plating, which is useful in reflectors; and on the deposition of tungsten, manganese, thallium, rhenium, and other rare metals that are not yet applied commercially. Alloy deposition has received much study, though brass plating is the only present extensive application.

The above examples should suffice to show that there has been a veritable renaissance of scientific interest in electrodeposition, which has extended through Europe and America, and even to China and Japan. To keep abreast of the times, or better still, ahead of the times, every progressive manufacturer will find it necessary either to conduct or to co-operate in research on plating; and must then endeavor to apply the results to his own processes and products.

Effect of Sodium Cyanide, Sodium Carbonate *and* Rochelle Salt *on the* Cathode Efficiency *of a* Copper Electroplating Solution

ABSTRACT

THE effect of free sodium cyanide, sodium carbonate and rochelle salt upon the cathode efficiency of a cyanide copper plating bath was investigated. Additions of sodium cyanide were made to the bath at the rate of 5 g/l (0.67 oz/gal) until 25 g/l (3.3 oz/gal) had been added. A commercial deposit (22% cathode efficiency) was obtained when 15 g/l (2 oz/gal) of free sodium cyanide had been added. Additions of anhydrous sodium carbonate increased the cathode efficiency to 59% and improved the deposit. A rochelle salt bath produced the best deposit in appearance and thickness (at a cathode efficiency of 95% and a temperature of 54.4°C (130°F). The lowest resistivity of the electrolyte was found to be 5 ohms per cm^3.

Read by ALBERT HIRSCH[1]

December 3, 1937, at the Krueger Club, to members of Newark Branch.

January 14, 1938, at the Pennsylvania Hotel, to members of New York Branch.

February 18, 1938, Harrison Laboratory of Chemistry, U. of P., Philadelphia Branch

HISTORICAL

Whenever a discussion of a cyanide copper solution takes place the following questions are asked:—What is the free sodium cyanide content of the bath? Do the carbonates that built up in the solution give any trouble? How does rochelle salt affect the deposit? Rarely are questions asked about the cathode efficiency, the resistivity or the conductance of the electrolyte although these three factors govern the cost of depositing copper from a cyanide bath. Hence the necessity of this investigation.

EXPERIMENTAL

Current was supplied by a small six volt generator set. A Gotham Cell containing the copper bath was connected in series with a copper coulometer. Exactly 800 ml of electrolyte were contained in each cell.

[1] *Electroplater and Chemist*, Snyder Inc., Mfg. of Automotive and Radio Specialties, Philadelphia, Pa.

THE COPPER COULOMETER

A copper sulphate solution containing approximately 150 g $CuSO_4$ $5H_2O$ and 50 g of concentrated H_2SO_4 per liter was used in the coulometer.

Two pieces of sheet copper were used as anodes, which were placed flat against the glass sides of the cell, and which had a total exposed area of $0.5dm^2$ ($7.75\ in^2$).

The cathode material was also sheet copper with a total exposed area of $0.5dm^2$ ($7.75\ in^2$) both sides receiving the deposit.

THE COPPER SOLUTION

The Gotham Cell contained a copper cyanide solution of the following initial composition:—

Compound	*g/l*	*oz/gal*
Sodium cyanide	25.0	3.3
Cuprous cyanide	22.5	3.0

The bath was filtered after preparation to insure a clear solution. This amount of sodium cyanide was just sufficient to dissolve the amount of cuprous cyanide taken, to give the complex cyanide $Na_2Cu\ (CN)_3$. This original solution thus contained no free sodium cyanide.

Two copper anodes, each having an exposed area of 12.90 cm^2 ($2\ in^2$) were used, one on each side of the cell.

To receive the copper deposit, six cathodes of sheet copper, having the same size and shape as the cathode used in the copper coulometer, were prepared. The plating time was half an hour for each deposit, no agitation was used in these experiments.

CALCULATION OF CATHODE EFFICIENCY

The cathode efficiency of the copper bath was determined after the addition of sodium cyanide, sodium carbonate or rochelle salt by a method described in a previous paper[2].

MEASUREMENT OF RESISTIVITY AND CONDUCTANCE

The resistivity of the bath was measured using a Haring Cell and the method described by Blum and Hogaboom[3]. The total resistance (R) of the electrolyte was obtained by measuring the voltage (E) across the middle compartment of the cell with the current (I) flowing and applying Ohm's Law, $R = \frac{E}{I}$. The resistivity was then calculated by multiplying this determined resistance by 5[4], the product being the resistivity (in ohms per cm^3) of the bath.

Conductance was determined by calculating the reciprocal of the resistivity.

EFFECT OF FREE SODIUM CYANIDE ON THE CATHODE EFFICIENCY

To the original copper solution, as previously mentioned, additions of solid sodium cyanide were made in amounts of 4 g. to the 800 ml. of solution used, corresponding to increments of 5 g/l, until a free cyanide concentration of 25 g. sodium cyanide per liter had been obtained. This corresponds to about 100% excess free sodium cyanide and caused a marked decrease in the cathode efficiency.

After each addition, one of the prepared cathodes was weighed and placed in the solution, and plated without agitation for 30 minutes under approximately standard conditions. At the end of the plating time the cathode was removed, washed in distilled water and alcohol, and then air dried. It was reweighed, in order that the cathode efficiency could be determined, and the deposit inspected.

The results of this series of experiments are summarized in Table 1, while the cathode efficiency, resistivity and conductance of the solution are plotted against the excess free sodium cyanide concentration in fig. 1.

From fig. 1 it will be seen that the cathode efficiency is decidedly decreased by the addition of excess sodium cyanide. This is most probably due to the diminution of the copper ion concentration caused by the increased concentration of free sodium cyanide. As would be expected, the additions of sodium cyanide decreased the resistivity and, correspondingly, increased the conductivity.

By visual inspection under a microscope, using reflected light, cathode No. 4, Table 1, was the only one to receive a deposit of commercial value. This was obtained when the free sodium cyanide concentration was 15 g/l (2 oz/gal), and the cathode efficiency was 22%.

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(2) Hirsch, The Effect of Free Sodium Cyanide and Sodium Carbonate on the Cathode Efficiency of a Silver Electroplating Solution. Proceedings, Am. Electroplaters' Soc. Convention, June, 1937, p. 70.

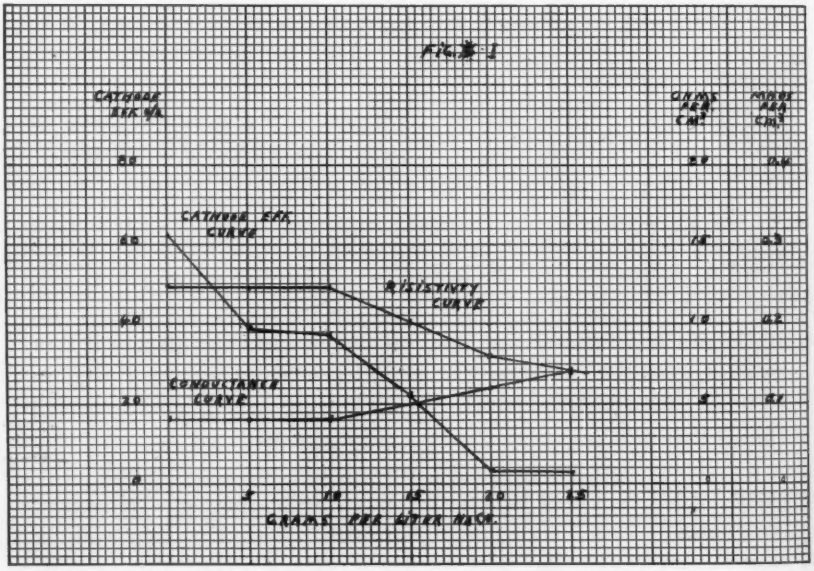
(3) Blum & Hogaboom, "Principles of Electroplating and Electroforming", 2nd Ed., (1930) p. 71-7.

(4) This constant results from the dimensions of the cell used, as shown by Blum & Hogaboom, Loc. ciT. p. 77.

Table 1.

EFFECT OF FREE NA CN ON THE CATHODE EFFICIENCY

Cathode No.	Temp. degrees C.	Amperes per 0.5 dm²	Volts	Resis. ohms cm³	Conduct. mhos	g/l NA CN	Cathode Eff. %	Deposit
1	28	0.1	1.0	12.5	0.08	0	62.0	Dense bright red
2	28	0.1	1.0	12.5	0.08	5	38.3	Dark red streaky
3	28	0.1	1.0	12.5	0.08	10	37.5	Dark red
4	28	0.1	1.0	10.0	0.1	15	22.0	First usable deposit
5	28	0.24	1.2	8.0	0.12	20	3.0	Very thin
6	28	0.28	1.2	7.1	0.14	25	2.63	Very thin



EFFECT OF SODIUM CARBONATE ON THE CATHODE EFFICIENCY

A new copper electroplating solution was prepared for the purpose of investigating the effect of anhydrous sodium carbonate, as an addition agent, on the cathode efficiency. On the

basis of the results described in the previous section the following bath composition was selected for the initial bath of this series:—

Compound	*g/l*	*oz/gal*
Sodium cyanide	25.0	3.3
Cuprous cyanide	22.5	3.0
Free sodium cyanide	12.0	1.6

Anhydrous sodium carbonate was added to the above electrolyte at the rate of 20 g. per liter until 100 g. per liter had been added. Six cathodes were run, one after each addition of sodium carbonate. The cathode efficiency was determined as described above, no change was made in the copper content during the experiment, and the excess free sodium cyanide was maintained at about 50% excess, i.e.; at 12 g/l. The temperature of the bath was 25° C (77° F), the C.D. 0.2 amp/dm^2 (1.86 amp/ft^{2}0, voltage across the cell, 1 volt, and the time of plating was one half hour for each run. The cathode efficiency increased after each addition of sodium carbonate. (See fig. 2). As would be expected the sodium carbonate lowered the resistivity of the copper cyanide bath and hence increased the conductivity. Consequently the cost of copper deposition from a cyanide solution is decreased by the presence of carbonates. Cathodes 10, 11 and 12, table 2, received the best deposits in this series.

EFFECT OF ROCHELLE SALT ON THE CATHODE EFFICIENCY IN THE PRESENCE OF CARBONATES

At this point the bath had the following composition:—

Compound	*g/l*	*oz/gal*
Sodium cyanide	25.0	3.3
Cuprous cyanide	22.5	3.0
Free sodium cyanide	12.0	1.6
Sodium carbonate	100.0	13.4

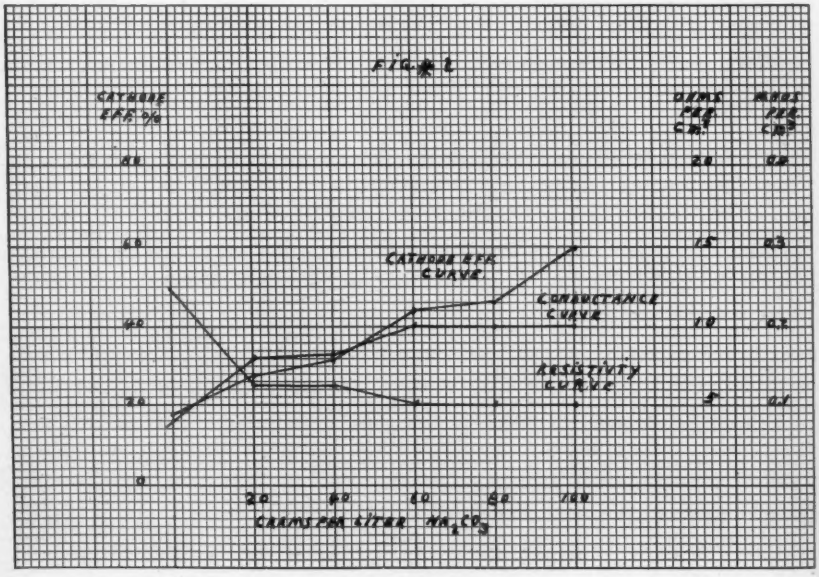
This electrolyte was filtered and rochelle salt was added in portions of 20 g/l until a total of 80 g/l had been added. Four cathodes were plated, the cathode efficiency for each deposit being determined. The results obtained in this third series of experiments are given in table 3 and fig. 3.

The rochelle salt additions to the above copper solution containing carbonates increased the cathode efficiency from 59% to 74%.

The resistivity measurements were difficult to make because of the pronounced polarization effects produced by the addition of rochelle salt. The data given in table 3, show that the resistivity of the solution remained constant on the additions of rochelle

Table 2
EFFECT OF $NA_2 CO_3$ ON THE CATHODE EFFICIENCY

Cathode No.	Temp. degrees C.	Amperes per 0.5 dm^2	Volts	Resis. ohms cm^3	Conduct. mhos cm^3	g/l NA_2CN_3	Cathode Eff. %	Deposit
7	25	0.1	1	12.5	0.08	0	17.8	Thin dark red
8	25	0.1	1	6.25	0.16	20	27.0	Semi bright red
9	25	0.1	1	6.25	0.16	40	31.55	Deep velvety red
10	25	0.1	1	5.0	0.2	60	43.46	Even Mat.
11	25	0.1	1	5.0	0.2	80	46.0	Nice even mat.
12	25	0.1	1	5.0	0.2	100	59.5	Mat.



salt at 5 ohms per cm^3, the voltage also, remaining sensibly constant, while the amperage decreased.

ROCHELLE SALT BATH WITHOUT CARBONATES

A fresh electrolyte was prepared having the following composition:—

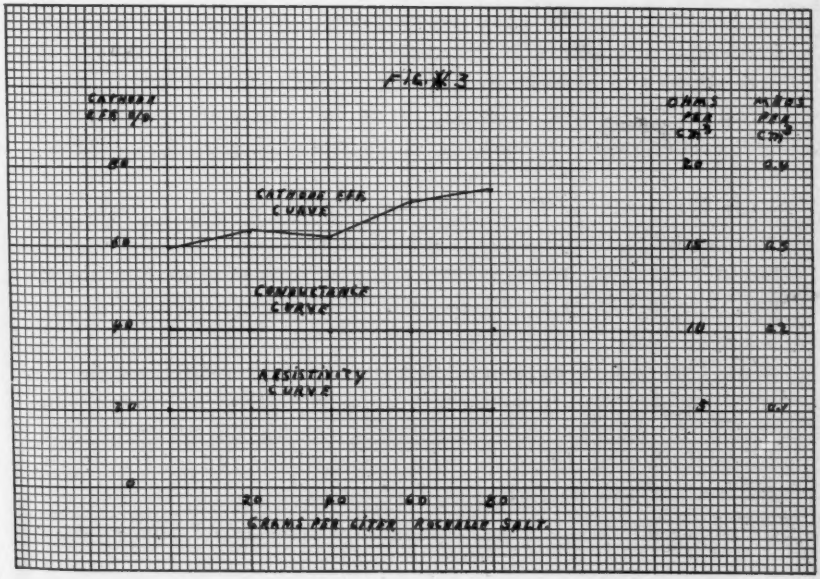
Compound	*g/l*	*oz/gal*
Sodium cyanide	25.0	3.3
Cuprous cyanide	22.5	3.0
Free sodium cyanide	15.0	2.0
Rochelle salt	45.0	6.0

At a C.D. 0.2 amp/dm^2 (1.86 amp/ft^2), with 1 volt between the anode and cathode, and at a temperature of 25° C (77° F) this solution gave a cathode efficiency of 51.5%.

Table 3

EFFECT OF ROCHELLE SALT ON THE CATHODE EFFICIENCY

Cathode No.	Temp. degrees C.	Amperes per 0.5 dm^2	Volts	Resis. ohms cm^2	Conduct. mhos cm^2	g/l Rochelle salt	Cathode Eff. %	Deposit
13	29	0.1	1.0	5	0.2	0	59.5	Velvety red mat.
14	29	0.08	1.2	5	0.2	20	63.4	Improved appearance
15	29	0.07	1.2	5	0.2	40	62.0	Same
16	29	0.06	1.2	5	0.2	60	70.8	Same
17	29	0.04	1.2	5	0.2	80	74.0	Same



In order to study the effect of the copper ion concentration upon the cathode efficiency, the cuprous cyanide content of the above solution was doubled, the combined sodium cyanide concentration being correspondingly increased, to give a solution having the following composition:—

Compound	*g/l*	*oz/gal*
Sodium cyanide	50	6.6
Cuprous cyanide	45	6.0
Free sodium cyanide	15	2.0
Rochelle salt	45	6.0

With a C.D. 0.2 amp/dm^2 (1.86 amp/ft^2), a voltage of one, and a temperature of 25° C (77° F) this bath gave a beautiful deposit and a cathode efficiency of 80.5%.

By increasing the temperature to 54.4° C (130° F) the C.D. increased to 0.4 amp/dm^2 (3.72 amp/ft^2), the voltage remained constant at 1 volt, and the cathode efficiency increased to 95%[5].

SUMMARY

(1) From a sodium cyanide copper electroplating solution containing 45 g/l cuprous cyanide, 45 g/l rochelle salt and no carbonate, the best deposit, with respect to appearance of deposit and cathode efficiency, was obtained when the free sodium cyanide concentration was 15 g/l (2 oz/gal).

(2) Since the sodium carbonate increased the cathode efficiency of a bath containing only cuprous cyanide and sodium cyanide, and that, rochelle salt increased the cathode efficiency over and above the highest cathode efficiency obtained with sodium carbonate, it seems essential, to have both sodium carbonate and rochelle salt present in a cyanide copper electroplating solution.

(3) By doubling the copper concentration of the bath, i.e.: increasing the cuprous cyanide concentration from 3 to 6 oz/gal, and increasing the temperature of the bath, the cathode efficiency was increased from 51.5% to 95% or approximately an increase of 100%.

(4) The results obtained, suggest the following composition for a satisfactory rochelle salt copper plating bath:—sodium cyanide 50 g/l (6.6 oz/gal), cuprous cyanide 45 g/l (6 oz/gal), sodium carbonate 45 g/l (6 oz/gal), rochelle salt 45 g/l (6 oz/gal), and free sodium cyanide 15 g/l (2 oz/gal).

(5) Cf. Hogaboom, "The pH of Alkaline Plating Solutions", Proceedings of Am. Electroplaters' Soc., Convention, June, 1937, p. 183.

Here and There

REPORT
SECOND ANNUAL EDUCATIONAL SESSION AND BANQUET

The Second Annual Educational Session and Banquet was held Saturday afternoon, November 5th, 1938, at the Hotel Elton, Waterbury, Conn. The educational session was held in the afternoon and consisted of three papers. The Chairman of the session was Mr. W. J. R. Kennedy, Supreme Secretary of the Society.

The first paper was "Coloring of Metals" by George D. Hogaboom, which included an exhibit of all types of finishes imaginable. One of the groups of finishes had been produced in Japan but they were not finishes which we would ordinarily consider to be commercial in this country because there was considerable hand painting done on the panel which would be classed more as art than as a commercial finish.

The second paper was given by Mr. Oscar Stocker on "Bright Nickel Plating". He gave a talk on the general characteristics of organic bright nickel solutions and a very detailed account of the precautions to be taken when setting up and operating one of these baths.

The third paper was given by Mr. Derrick S. Hartshorn on "The Determination of the pH of Hot Nickel Solutions". Although most people feel that nickel solutions are apt to become alkaline during use, it was interesting to learn that at times they do become acid and require the addition of alkaline constituents to correct the pH. Mr. Hartshorn gave a report of the work he has done on the addition of alkalies to correct the pH of solutions with which he is familiar.

Approximately seventy-five people attended the Educational Session which was over at five o'clock. The banquet in the evening was served at about eight o'clock, and together with the entertainment and distribution of door prizes required until well after ten o'clock. The entertainment appeared to have been enjoyed by all, particularly the announcement of the National Convention to be held in Newark next June. Mr. Horace Smith gave the announcement and was particularly insistent that the ladies should be brought to the Convention as special accommodations would be made for them. Dancing continued until midnight to the music of Cliff Slater's Orchestra.

The Committee for the arrangement of the afternoon and evening affair consisted of Messrs. E. T. Candee, Louis F. Lougee, William S. Gray, Richard D. Crane and Tennant Elwin.

E. T. CANDEE, *Sec.*
Waterbury Branch, A.E.S.

BINGHAMTON Secreatry George Simmons of the Binghamton-Elmira Branch announces that the Branch voted at the last meeting to change the name to Binghamton-Syracuse. It seems there are more members and prospects in the Syracuse district than in Elmira.

PITTSBURGH The Pittsburgh members have a very comfortable meeting place in the Bureau of Mines. At the regular meeting held November 4th, Mr. F. F. Oplinger of the duPont Co., gave a splendid address on "Hot Copper Solutions." There was a fairly good attendance. Mr. Oplinger was kept busy answering questions for an hour after he ended his address. Mr. Stanley Hedden, Secretary of Pittsburgh Branch acted as Chairman in the absence of the President.

WATERBURY The following speakers are scheduled as speakers at the Waterbury Branch Meetings for the coming months.

Dec. 9	F. F. Oplinger	duPont deNemours Co.	Unannounced
Jan. 13	W. A. Helbig	Darco Corporation	"Activated Carbon for use in Plating Solutions."
Feb. 10	L. F. Loutrel	Monsanto Chemical Co.	"The Use of Ferric Salts for the Pickling of Copper Alloys."

Mar. 10 E. J. Weaver Johns-Manville Sales "Celite, The Story of the Diatom"
Apr. 14 Dr. Wm. Stericker Philadelphia Quartz Co. "Alkaline Detergents"

ROCHESTER Branch held their Annual Bowling Party and "Phun Nite" at the Pines, one of Rochester's finest Bowling Halls on Saturday evening Nov., 19th. This should have proved a successful affair. We hope some of the members of Rochester Branch will send us the details for publication in the December REVIEW.

GRAND RAPIDS We wish to thank the members of Grand Rapids Branch for their fine co-operation in bringing in new members, their enthusiasm and lively branch meeting. It is a pleasure to read Mr. Whalley's reports. Grand Rapids has elected 13 new members, reinstated 1 and suspended one since September 1st. Nice work boys! Keep it up!

BOSTON Mr. A. W. Garrett, Secretary of Boston Branch writes: The Convention Proceedings are without a doubt one of the finest ever printed and the members of Boston Branch like their copies very much. It's worth $6.00 of any Plater's money to be able to have one of these copies every year.

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pH DETERMINATION

A simple method for the practical Plater, by Paul Frank, 456 4th Ave. Hull, N. Y.

Although the importance of the control of pH in plating solutions has been generally recognized, there still seem to be many platers who are inclined to wait till they experience trouble with their solutions before they take pH measurements. This is a very short-sighted policy: pH measurements are intended to avoid trouble. Constant results can only be obtained with constant pH.

It is possible that the many different methods available for measuring pH, some of them requiring special care, had a somewhat deterrent effect upon the practical plater, the more so as they sometimes seem to give divergent results. For instance, if an indicator solution of Brom-Cresol Purple is being used, results obtained are higher than electrometric measurements. Or if he tests an alkaline solution containing sodium and uses a glass-electrode, his pentiometer will indicate results somewhat at variance with the true pH. Even measurements with a hydrogen-electrode, the basic instrument for all pH measurements, will show variations if impurities are present, or if weakly buffered solutions between 5.0 and 8.0 pH are being tested. The presence of certain chemicals, salt-contents, temperatures, etc., exercise an influence upon readings obtained. These divergencies are not a serious obstacle and in many cases can be computed, but they may easily seem confusing.

About a year ago a new method was introduced in this market under the name of pH PAPERS, after it had been developed and put to the test of practical experience. Unlike the other methods known, which are marketed for GENERAL application, a series of these pH Papers was developed to meet the well-known and DEFINITE conditions and requirements of the electro-plating industry. They were calibrated accordingly and give correct measurements. Based on true electrometric measurements, they do not require any rectification for salt contents, sodium, etc. They consist of strips of a special paper, impregnated with a highly sensitized indicator and a number of control-colors, all on the same strip. Measurements are obtained by simply dipping a strip for one or a few seconds, depending upon the type of solution, and by comparing then the indicator with the control-colors. This simple method enables the plater to go from tank to tank, make the test right at the spot and simply discard the strip after it has been read. It requires no apparatus or instrument. A great deal of time is saved and regular and sufficiently frequent tests can be made without inconvenience.

At present the following strips are available:

No. I	5.2— 6.7 for ordinary nickel solutions (cold)
II	3.6— 5.0 for warm nickel, also bright nickel
III	3.7— 5.3 special strip for ACID zinc
IVa	1.9— 3.4 bright and low pH nickel
V	0.9— 1.5 acid, copper, etc.
VI	9.2—11.0 alkaline plating solutions and cleaners
VII	11.0—13.5 alkaline plating solutions and cleaners

The entire pH range, as used in plating solutions, is therefore effectively covered. Control-colors are in steps of 0.3 pH, insuring pH control sufficiently close for all practical purposes.

Platers who have been using Bromcresol-Purple for testing nickel solutions should bear in mind that results obtained by tha tindicator are about 0.3 pH higher than results indicated by the electrometric method or by pH papers.

What are pH Papers? pH Papers are strips of a special paper, impregnated with a highly sensitized indicator and a number of control bars (colors) each bar being of a different color and representing a definite pH value. When these strips are dipped into the solution for one or a few seconds (the length of time required depending largely upon the salt-contents of the solution) the indicator will change color. By comparing the color of the indicator with the colors of the control bars, the pH value can be read off instantaneously.

The advantages and the great ease of this method are too obvious to need much stressing. They are especially great in industrial operations where the operators can do their own testing. For field work these pH Papers are ideal.

No apparatus or indicator-solution is required. Just a strip of pH Paper, nothing else. There is also no more need for taking samples. The test is made right at the tank or container. Anybody can do it immediately.

pH Papers come in handy boxes, easily carried, and containing 200 strips of a number. Any particular number usually extends over a pH range of 1.5 pH or more. pH Papers will not deteriorate with age.

pH Papers are available in a variety of standard numbers but they can be made to meet any special requirements where such special manufacture would be warranted. Kindly state your problem and propositions to meet it will be readily submitted.

OAKITE SERVICE DIVISIONS HOLD TECHNICAL SALES CONFERENCES

Two-day technical sales conferences are currently being held by various service divisions of Oakite Products, Inc., The Essential purpose of these conferences is to keep users of Oakite materials acquainted with new developments and improvements in methods and materials that apply to their processing or plant maintenance cleaning operations.

Under the direction of Division Manager J. C. Leonard, the Chicago Division convened at the Hotel Statler in St. Louis, Nov. 18-19. The Detroit Division, headed by H. C. Duggan, gathered at the Hotel Statler in Detroit, Nov. 21-22. The Northeastern Division meets at the Commodore Hotel in New York, Dec. 2-3, with Division Manager D. X. Clarin in charge. The Philadelphia Division, of which J. J. Basch is manager, is scheduled to hold their meeting at the Hotel Pennsylvania, New York, Dec. 9-10. In addition to the 90 Oakite representatives, the conferences are being also attended by J. A. Carter, H. L. Gray, Assistant Managers, and E. C. Rinker and Wm. A. Allison of the Oakite Technical Research Department. Date of the West Coast Division Conference will be announced later.

Subjects discussed include cleaning before bright nickel and chrome plating; removal of sludge, grease, oil deposits and other accumulations from Diesel crank cases and inside surfaces of gasoline and Diesel engines with a cold cleaning solution; and cleaning and anti-rusting metal parts between various fabricating operations.

MR. AND MRS. JOHN OBERENDER CELEBRATE THEIR 35TH WEDDING ANNIVERSARY

One of the best known members of the A.E.S., Mr. John Oberender and Mrs. Oberender, 37 Sea View Ave., West Haven, Conn., celebrate their 35th wedding anniversary on Friday, November 25.

John, as he is known to most of us has been connected with the Zapon Lacquer Division of the Atlas Powder Co., Stamford, Conn., for twenty-one years, and has been sales manager of their New England Division since 1921.

He has been a member of the American Electroplaters' Society for twenty years, having joined the Bridgeport Branch in 1918. When the New Haven members decided to form their own Branch in 1937, Mr. Oberender was one of its organizers, and transferred his membership to the newly formed Branch, where he is still active. Mr. Oberender is among the few who can boast of continuous attendance at the annual conventions of the Society, and has not missed a convention since 1916.

Mrs. Oberender is also a familiar figure at the annual meetings of the National Society and has attended most of the banquets and social events in this section for many years.

Our membership extends to both Mr. and Mrs. Oberender our best wishes for continued health and happiness and our appreciation of their loyalty and support of the social, educational, and advertising programs of our Society, both local and national.

An Innovation

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In future issues of the "REVIEW" will be found a page which has been given to the International Fellowship Club. This page is to be used by the club for furthering its aims and purposes. It is given to our club in recognition of the good feeling that exists between the Electroplaters' Society and the International Fellowship Club. This is as it should be, as a great many members of our club are also members of the A.E.S.

The aims and purposes of the International Fellowship are as follows:

1. To have an organized body representing the suppliers for any purpose for which such organization is required.

2. To have an organized body to look after the interests of those engaged in supplying products or services to the plating industry.

3. To bring about a closer relation of confidence and friendship among all engaged in supplying the requirements of the plating industry.

4. To establish and enforce a code of ethics among those so engaged.

5. Further information on this matter can be had by reference to our established and published code of ethics. In future articles for the "REVIEW" your Chairman intends to ask the past Chairmen in their rotation for an article, the subject of which will be left entirely with the author, but it is suggested that they conform to the aims and purposes for which our club was organized.

The article for the December issue of the "REVIEW" will be a history of our club by Mr. Wilfred McKeon, our first Chairman, and no one is better qualified to do this than "Mac".

OLIVER SIZELOVE, President of
the International Fellowship Club

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTROPLATERS' SOCIETY

NEW HAVEN BRANCH

The first meeting of the New Haven Branch was held Thursday evening, October 13, at the Sterling Chemistry Lab. of Yale. A short business meeting was held, and then the members adjourned to a large lecture hall where there was an educational session with Mr. Austin B. Wilson as the guest speaker.

The business meeting opened at 7:35 P.M. with President Joe Downes in the chair. The minutes of the previous meeting were read and approved. Several communications were read and placed on file. A motion was carried to the effect that the Secretary should write a letter to Mr. E. T. Candee, Sec'y-Treas. of the Waterbury Branch, and express the willingness of the New Haven Branch to co-operate in having a joint meeting with the other Conn. Branches and the Springfield Branch. This meeting is to consist of an educational session and banquet.

A motion was made and passed that Tom Chamberlain and the Educational Committee take care of the preparations of a paper to be presented by the New Haven Branch at the National Convention in Asbury Park, N. J., next June.

The following applications were received for membership:

James J. McTigue, Active, New Haven Plating and Finishing Co., 1245 Chapel St., New Haven.

Lee Stevens, Active, International Silver Co., 320 Cook Ave., Meriden, Conn.

Elected:

Paul M. Cunningham, Associate, Oakite Prod. Co., 169 Fountain St., New Haven.

The meeting adjourned at 8:00 P.M.

Mr. Wilson's lecture entitled "Electroplating and Metal Finishing in the Automotive Industry" proved to be a very interesting and informative view on the subject. Accompanying the lecture was a movie "Tough Friends", which dealt with metals and alloys used in the automotive industry. Another film entitled "Precision Measurements" depicted the many improvements made in measuring devices and the great precision and quickness that are now obtained and required in modern production.

Some two hundred people, consisting of members of the other Conn. Branches and guests, attended this session.

The class in the "Fundamental Principles and Theory of Electroplating" will get under way Tuesday, October 25.

Mr. W. A. Helbig, Asst. Eng. of the Sales Division of the Darco Corp. will be guest speaker at the next open meeting to be held Tuesday, Nov. 1, at the Sterling Chemistry Lab. He will talk on "Activated Carbon and Electroplating Solutions".

JOSEPH T. SULLIVAN, *Sec.-Treas.*

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HARTFORD BRANCH

The Hartford Branch of the A.E.S. held its October meeting on Monday evening, Oct. 17, 1938, at the Elk's Club, Bristol, Conn.

The meeting was called to order at 8:15 P.M. with Pres. Pietro in the chair. Minutes of the previous meeting were read and accepted. All communications were read and placed on file.

Mr. H. C. Duggan, associate of the Hartford Branch was granted a transfer to the Detroit Branch.

One application from Mr. Frank J. Ciaramella for active membership was received and voted to take the usual course.

Mr. A. W. Tracy, assistant metallurgist at the American Brass Company, Waterbury, Conn., was guest speaker for the evening, and gave a talk on "Corrosion of Metals", which was well received. He also told of his experiences as one of the examiners of test panels being conducted by the A.E.S.

After a half hour of answering the various questions pertaining to different types of metal corrosion, Mr. Tracy was given a rising vote of thanks.

The meeting was attended by twenty-two members and was adjourned at 10:30 P.M.

V. E. GRANT, *Sec.*

BOSTON BRANCH

Boston Branch met Thursday the 3d at the Bradford Hotel, Boston, with President DeLorme in the chair.

Minutes of the previous meeting read and approved. Communications read and placed on file, bills read and paid.

The letter in regards to the coming convention will be taken up at the next meeting.

Two applications were read for the second time and approved by the board of managers, were elected to membership as follows: George P. Swift, Mass. Int. Tech., Cambridge, Mass., Associate and Louis Tosi, 138 Rindge Ave., Cambridge, Mass., Associate.

Three applications were read for the first time and turned over to the board of managers for approval as follows: Louis V. Gagon, 259 Health Street, Roxbury, Mass., Associate; Benedict W. Bertini, 50 Hillcrest Ave., Lexington, Mass., Associate; and Rudolph G. Loeser, 8 Brazil Street, Melrose, Mass., Associate.

Mr. Frank Clark was with us and he is always welcome to our branch as he helps out in making the meeting worth while. Come again, Frank.

We were to have a speaker for this meeting but because of other business he could not come, but plans will be made to have him at one of our future meetings.

Mr. Stanley Knight acted as librarian and held a question box for the members; questions such as the use of cadmium in silver solutions, the pH of rochelle salts copper solution, cobalt in nickel anodes. They were very interesting and the discussion that followed lasted for more than an hour.

The members were asked to read some kind of a paper and also to try and get ads for the REVIEW. You can find the prices for these ads in your last REVIEW. Look it over and do something to help the society advertise in your own MONTHLY REVIEW.

Meeting adjourned at 10:30 p.m.

A. W. GARRETT, *Secy.*

BINGHAMTON-SYRACUSE BRANCH

The first educational meeting of the current season was held at the Cortland Hotel, Cortland, N. Y., October 28.

Dr. Walter Meyer, the new editor of *The Metal Industry* who is well known to all our Branches, was the speaker, his subject being "Metallic Impurities and Brighteners in Plating Solutions". This proved to be a very interesting subject with some good slides and of course ably handled by the speaker.

The good or harmful effects of Silver in Cadmium, Cadmium in Copper, Zinc in Copper, Zinc in Nickel, Cadmium in Nickel, Nickel in Cadmium, and many others were clearly shown on the slides. Along these same lines one of our members who is plating Copper on Steel for rubber adhesion told of the remarkable benefits obtained by the additions of Tin to the Copper. Dr. Meyer spoke briefly (too briefly we thought) on the addition of Cobalt to Nickel for the control of pitting, the theory in this evidently being that the Cobalt completely reverses the crystal structure of the deposit, this seems to open up a new field for the elimination of our old enemy the pit and we certainly should hear more about it in the near future.

A remarkable job of Nickel on Steel is being done by our President Bill Mahar. He had Dr. Meyer half convinced that after all Faraday was a human being and could have made a mistake. We intend to look into this further.

Dr. Meyer left at 11 p.m., to catch a train. This branch wishes him all the success due him in the field of journalism.

The letter of Mr. Geo. Hogaboom, relative to a Branch paper to be given at the International Convention next year was read and action to be taken on it at our next meeting.

Two new memberships were acted upon.

One of our members reported having trouble oxidizing from a Rochelle Salt Copper. From a Cyanide Copper he could oxidize direct but from the Rochelle Salt bath he had to scratch brush first. Any information on this will be appreciated.

Meeting adjourned at 11:30 p.m.

GEO. SIMMONS, *Sec.-Treas.*

EXPERIENCED ELECTROPLATERS
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Copper Anodes

... because their unexcelled purity assures uniform corrosion, the highest quality deposit in the shortest possible time and low scrap losses. Furnished with suspension holes drilled as desired, or tapped for end hooks.

ANACONDA

THE AMERICAN BRASS CO.
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Offices and Agencies in Principal Cities

LOS ANGELES BRANCH

The regular monthly meeting of the Los Angeles Branch of the American Electroplaters' Society held October 12, 1938 at the Rosslyn Hotel. President, Earl Coffin, presided. Minutes and financial report of the previous meeting were read and accepted. Bills were read and ordered paid.

Mr. Roger W. Sundmark was elected associate member of the Society.

Mr. E. R. Holman presented some

interesting facts regarding pH measurements.

The following questions were found in the Question Box:—

Q. Work plated in a copper cyanide solution and oxidized with liver of sulphur has a gray appearance. What can I do to get deep black color?

A. Stale liver of sulphur could cause this. Use fresh liver of sulphur and add small quantity of ammonia.

Q. Brass plated comes out of the tank with a heavy fuzzy loam after being plated 15 minutes. What can be added besides arsenic to make the plate smoother?

A. Add small quantities of Sodium Bisulphite.

Q. Is it possible to chrome plate directly on dural?

A. Method for doing this can be found in the 1938 October issue of the *Metal Industry*—page 475.

Q. Would like a formula for stripping poor silver deposits from brass without etching the brass surface.

A. Use a concentrated solution of sulphuric acid—hot—and add small quantity of potassium nitrate. Keep moisture out of this solution.

Meeting adjourned at 11 P.M.

RAYMOND SOLIVAN, *Sec.-Treas.*

TORONTO BRANCH

Oct. 24 meeting held in our new quarters, the King Edward Hotel—Room G, president John Acheson in the chair and 27 members to answer the roll call. Vice-president Archie Smith with table and chair, finally found location directly facing the throne. With him were 4 visitors from the Coulter Copper and Brass, and with Jack McLean were 2 visitors from the Canada Cycle. The president in welcoming them stated that the door of the Toronto Branch was always open to anyone interested in the electrodeposition of metals and called for the first order of business.

Two new applications were received and one reinstatement while seven applications were balloted on and added to our roll. Under good and welfare our president gave a paper on Modern Methods of Electroplating or Bright Nickel Deposit. Going from Dr. Adam's to Dr. Watt's solution of the present day, saying that bright nickel solutions had been in use for quite a number of years, but the thin deposit would not fill the bill for present day use; stressing the fact that the Watt's solution and the added brighteners was perhaps not all that was desired but it helped to heal or bridge the gap of a feud for the last decade between the manufacturer and the buffer. His motto of doing one thing at a time to a successful end, was noticeable throughout his paper which was a good one and well received, along with the 40 odd samples which he certainly did not pick up in one shop. It was one of the best illustrated papers ever read at a Toronto Branch meeting.

Questions asked the speaker were:—

Q. Anodes, chemicals, etc.

A. Anodes of the cast variety and hung in bags. Chemicals of the highest standard, advocating filtering and agitation. 60 amps/sq. ft. average articles on show were plated 35 amps/sq. ft. for 15 minutes.

Questions found in Question Box:—

Q. What causes rainbow colors in chrome plated work?

A. Too low or too high sulfate content.

Q. What other metal other than copper would be more serviceable for anode hooks in cyanide copper tank?

A. Iron or stainless steel.

Q. What is the true color of bright chrome deposit?

A. Blue white.

JAMES S. CAIRNS, *Rec.-Cor.*

ROCHESTER BRANCH

The Rochester Branch held its regular monthly meeting at the Hotel Seneca on Friday night, Oct. 21. Meeting was called to order by President Del Rosso and regular business was transacted during which the chairman of the entertainment committee, Mr. Art Moore, reported all in readiness for the biggest Annual Bowling Party and Fun Night in the history of the Branch. He warned every one to hold the night of Saturday, Nov. 19th, for this party or they would surely regret not having attended. After routine business a very instructive discussion was started by Mr. Dougherty which lasted to a late hour after which the meeting was adjourned.

JUDSON R. ELSTER, *Sec.*

PROVIDENCE-ATTLEBORO BRANCH

Held its regular meeting, on the third Monday, October 17th, at Narragansett Hotel; Mr. Chace called the meeting to order, and after brief remarks, called on the Librarian, Mr. Donald Wood, to take charge of the meeting.

Mr. Wood stated that he planned to have speakers for the coming meetings. He announced that the topic for the evening was: "Removal of Grease", and, reviewed a paper by the Hartford Branch, on the subject.

The REVIEW seemed to indicate that the job was quite simple, just a few operations, but, when the discussion among the members got under way, it seemed to be more complex.

Messrs. Don Wood, Mark Weisberg, Robert Maclachlan, John Clarner, Joe Smith, and Chas. Law, each had a special way of cleaning.

Donald Wood stated that a small % of averol in a caustic solution was found effective in removing the last traces of soap in the cleaning process.

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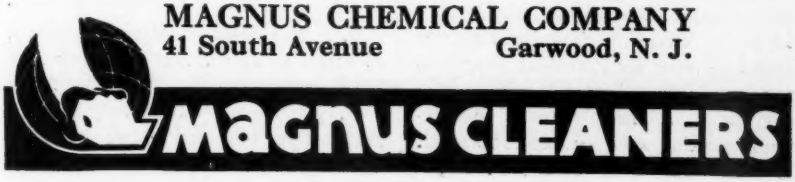

When asked why averol was preferred, he stated that in some of the operations the goods were bright-dipped and that even tho some of the avarol solution were carried to the dip, it would not cause any trouble, rather it would improve the finish.

Mr. Mark Weisberg gave some very good and interesting explanations of the chemical reactions and procedure and stated that solvent naphtha, or zylol, in the cleaner, is very effective in removing the grease.

Mr. Chas. Law stated that their method was to use a steel tank connected as anode, with an agitated cleaner containing soap. From the tank they rinsed in warm water, and then, placed the goods in a pickle of No. 26 degree muriatic acid; then in an electro-cyanide (cathodic), then rinse and into weak sulphuric acid, rinse and into the plating-bath.

Mr. John Clarner stated that cleaner contained no soap; that for steel with soft-solder they used an electro-cyanide, (anodic), and a quick copper strike to cover the solder.

Mr. Weisberg had the Convention Exhibit on display and talked for several minutes describing how they were produced.

There were 16 present.

Meeting adjourned 11:15.

The next meeting will be on the third Monday in November, the 21st.

J. ANDREWS, *Sec.*

GRAND RAPIDS BRANCH

The regular monthly meeting of the Grand Rapids Branch was held October 13 at the Y.M.C.A. The meeting was called to order by President Vlug who requested Mr. Charles Werft to preside for him. The minutes of the previous meeting were read and approved. Communications of George B. Hogaboom were read and accepted. The report of our Social and Educational Committee was delayed pending a meeting of those committees to be held October 17.

Four applications for membership in the Branch were received and were oked by the Board of Managers. The applications were then placed before the members for their approval. It was moved, supported and carried that the applications of the following persons be accepted: Edgar S. Bradley, Albert G. Tracy, Ivan Conrad Hepfer, James Bernard Haviland.

The meeting was then turned over to our Librarian, Mr. Homer Morton.

Q. I have heard about wetting agents, in nickel solutions. Am I liable to have trouble using one as an anti-pitter?

A. Wetting agents are very good as anti-pitters but one must be very cautious as the wrong one may cause

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no end of trouble. Some wetting agents bread down upon electrolysis in nickel solutions and are entirely unsuitable. One Chemical Co., which puts out a bright nickel, claims that there is no wetting agent obtainable on the open market that is suitable as it comes for a nickel non-pitter.

Q. Can coil strip brass be chrome plated?

A. It requires special equipment to plate coil strip stock. It would not be practical to attempt such plating on a small scale. Several companies can now produce very satisfactory chromium plated brass strip at a reasonable cost.

Q. Is there a good bright copper?

A. Dupont is said to have a very good bright copper solution. It plates about four times as fast as a regular copper solution. Special anodes, cathodic agitation, close analytical control, and automatic temperature control are some of the requirements.

Q. How about the new pH papers?

A. The new pH papers are very handy to carry and use in wide range of pHs. They are especially valuable to service men, salesmen, etc. Where the color tubes, colored glass standards, or electrometic pH equipment would be too cumbersome to carry. The papers are obtainable over any pH range. The electrometric sets are not used to determine pHs over 9.0. The color tubes and glass standards can be used over any pH range and are a little more accurate than the papers.

Q. Best way to strip nickel from steel?

A. Use sulfuric acid solution 55° Be′ (70% solution, Ye weight) with reverse current. To avoid pitting the steel, do not allow the Be′ to go below 55. Keep the temperature below 85° F. If pieces are removed and rinsed for inspection, dry before putting back into the strip. Some people recommend that when a new strip is made up, copper sulfate ¼ oz. per gal. be added.

CHAS. H. WHALLEY, *Sec.*

TOLEDO BRANCH

A regular meeting of the Toledo Branch, of the A.E.S. was held at the country home of Mike Spanolis, on Oct. 6th, 1938 with the following members present: Chas. Adamski, G. Bergeman, Joseph Di-Salle, James Gerity, Sr., Philip Hale, William Hunlock, Stanley Moore, Carlton Mitchell, James Nagle, Jr., S. C. Shank, Perrin Sines, Michael Spanolis, Edward St. Arnand, John Stegeman, Walter Weiker, and Walter Witkorowski. We also had with us as our guest, and speaker of the evening, our good friend Mr. Kennedy, Executive Secretary of the A.E.S.

The meeting was called to order at 8:00 o'clock by the President, Mr. Stanley Moore. The minutes of the previous meeting were read, and approved. A communication from George Hogaboom, Chairman of the Educational Committee was then read. and ordered filed for future reference, A discussion was then started by Mr. Weiker concerning the outing that was held last summer, and was finally decided that in the future tickets are to be sold in advance, so as to have some idea as to how many are going to be there. Mr. Carlton Mitchell, chairman of the membership committee, then reported, and four names were suggested for membership in the Toledo Branch. At this time Mr. Kennedy gave an informal talk, and gave a general report on the future program of the National Society, dealing with the new membership goal, the MONTHLY REVIEW, the convention proceedings,

the financial setup of the Society, etc., he asked that every member co-operate by sending practical papers on polishing, plating, and buffing, and shop problems, to him, that can be used for material in the MONTHLY REVIEW.

There being no further business before the meeting, the meeting was adjourned, and a lunch was served.

GASTON BERGEMAN, *Sec.*

NEWARK BRANCH

The regular meeting of the Newark Branch, A.E.S., was held on Friday evening, October 21, 1938, in the club room of the Hotel Douglas, Newark, N. J.

The meeting was called to order at 8:30 p.m. with President John Kotches presiding. Other officers present were: Jack Shamis, Vice-Pres.; George Wagner, Secretary; Nelson Sievering, Treasurer; Harmon S. Hunt, and George Reuter, Trustees.

The minutes of the previous meeting were read and approved. The following applications were voted to take the regular course: To Active Membership, (1) William Bruhns, (2) Clifford A. Marshall, (3) Christian P. Kuell. To Associate Membership, (1) George F. Geiger, (2) George C. Arnold, Jr., (3) Alexander Chowski.

The following members were reinstated to Active Membership: (1) William Betz, (2) Oscar F. Carlson.

Mr. Horace H. Smith announced that the New York and Newark joint banquet committee held a meeting prior to our regular meeting and stated that definite arrangements were being made for that affair which is scheduled

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for February 18, 1939, at the Roof Garden of the Hotel Pennsylvania, New York. He also stated that arrangements were being made for a bus trip for the members of Newark Branch who will attend the Philadelphia Banquet on November 19, 1938. The bus will leave the Pennsylvania Station in Newark at 10 a.m., and will leave Philadelphia for the return trip at 2 a.m. The fare will amount to about $3.00 per person. He then stated that he and the Secretary had completed plans for a joint Bingo Party with the Knights of Columbus to be held Tuesday evening, November 15, 1938, at the Mosque Ballroom. He asked each member to sell at least ten tickets for this affair. All the members promised to do their share and the Secretary was instructed to have the tickets printed immediately and distribute them among the members.

Our President then called on Mr. Ralph J. Ligouri and Mr. Franklyn J. MacStoker of New York Branch who gave their version on both the Joint Banquet and the coming Convention and asked the members to give their co-operation to their committees. They also offered the services of New York Branch for any assistance that we may need for the Convention.

The President then turned the meeting over to Robert R. Sizelove, acting Librarian, who presented Mr. Harmon S. Hunt, the speaker of the evening. His subject was: "Wetting Agents in Nickel Plating Solutions". The paper dealt mostly with further research in that subject. Mr. Hunt exhibited numerous samples which were plated in Nickel Solutions containing Wetting Agents. He also displated an apparatus for testing the adhesion of the deposit. This was one of the most interesting and instructive talks of the season and will be published in the "MONTHLY REVIEW" after the Philadelphia Banquet. Mr. Hunt was given a rising vote of thanks for his talk.

49 Members attended this meeting which adjourned at 11 p.m.

GEORGE WAGNER, *Sec.*

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NEW YORK BRANCH

The New York Branch resumed their bi-monthly meetings of the Fall and Winter seasons during the month of October, at their headquarters in the Hotel Pennsylvania.

At the first meeting of October 14th, the Librarian of the Branch, Dr. C. B. F. Young, inaugurated an extensive program of monthly lectures himself, with a talk on "Metal Coloring". His subject covered a wide range of process and metals and evoked much interest

and many questions from the large membership present. Dr. Young is to be congratulated for his efforts in arranging for a splendid list of speakers and subjects for the coming months. At this meeting the Branch was honored by a visit from Past Supreme President, Mr. Austin B. Wilson of Detroit. Mr. Wilson was called upon by President R. J. Liguori to address the membership present on national A.E.S. affairs. Mr. Wilson did so with vigor and appeal for co-operation in the National Membership Drive and assistance in furthering the campaign for advertising in the MONTHLY REVIEW. Mr. Wilson was questioned several times by members on matters in these connections. Both Dr. Young and Mr. Wilson were extended a rising vote of thanks by the Branch for their efforts of the evening.

On October 28th the Branch held a business meeting, followed by a round table discussion of problems taken from the Question Box, and spent an hour and a quarter in lively debate and explanation. Three applications for membership in the Branch were presented at these meetings to the Board of Managers.

F. J. MACSTOKER, *Sec.*

ANDERSON BRANCH

The regular monthly dinner meeting of the Anderson Branch of the A.E.S. was held on Monday evening, November 7, at the local Y.M.C.A.

Vice President C. F. Hauri presided due to the unfortunate illness of President L. R. Hinsch.

Mr. F. F. Oplinger of the R. and H. Chemical Division, of the E. I. duPont de Nemours & Co., Inc., was the main speaker of the evening. His subject was "The New High Speed, High Temperature Cyanide Copper Plating

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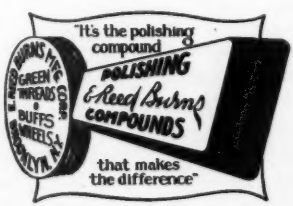

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Process". He described some of the things they went through in developing this process and in doing so disproved some of the old theories of cyanide decomposition and anode corrosion. He also described the conditions under which the bath should be operated and in what fields the bath could be applied. The talk was very interesting and many questions followed.

Meeting adjourned at 9:15 p.m.

E. L. MCKINNEY, *Sec.-Treas.*

MILWAUKEE BRANCH

The regular monthly meeting of the Milwaukee Branch was held on Thursday, November 3rd, 1938, at the Republican House.

President Dexter Rhodes presided, calling the meeting to order promptly at 8 p.m. There were 30 members and also several guests present. The roll call of officers found them all present with the exception of one member of the Board of Managers. The minutes of the previous meeting were read and approved. All communications were placed on file.

Mr. Robert Steuernagel, speaking for the Board of Managers, reports that all the plans have been made for the party that is to be held at the Elks Club on Saturday, November 26, for all Milwaukee members and their wives.

The meeting was then turned over to the Librarian, Mr. Henry Bornitzke, who introduced the speaker of the evening, Mr. M. Walker of Kirby & Cozeshaw Company, who gave a very interesting talk on "Electroforming". Mr. Walker answered many questions asked by the members and was given a vote of thanks for his fine explanation.

The following questions were found in the Question Box:

Q. Will filtering nickel solution tend to remove boric acid from the solution?

A. No.

Q. Which is the better to use in a nickel solution for pitting? Sodium Perborate or Hydrogen Peroxide?

A. Either one is suitable, but Sodium Perborate is preferred, because of the rapidity that Peroxide decomposes.

Q. Is there any special benefit to be derived if one operates a chrome solution at 55 ozs/gal. instead of 33 ozs/gal.?

A. No.

ROBERT B. GOODSELL, *Sec.-Treas.*

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DETROIT BRANCH QUESTIONS and ANSWERS

for September and October Meetings

Q. What is the approximate thickness of the electrocolor deposits?

A. These deposits are very thin when compared with metal deposits, but may be color buffed if plated to the darker shades of color.

Q. In cyanide copper, how does a dark red deposit compare with a pink deposit in adherence?

A. If the base metal is steel, poor adherence is more likely when the free cyanide is low and the deposit red in consequence. Pink copper is associated with high cyanide, and good adherence should result.

Q. What ratio of iron to copper anode area in a properly balanced copper cyanide bath will be most efficient in maintaining the metal concentration?

A. If the bath is used for long periods without interruption, very little steel anode area is needed. For intermittent operation, as much as 50% of the area may be steel. The degree of polarization of the copper determines.

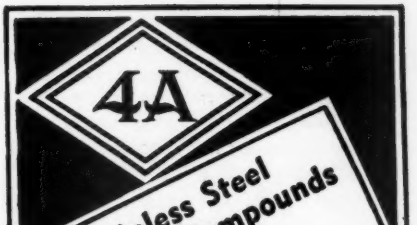
Q. May carbon tetrachloride be used instead of trichlorethylene for degreasing?

A. Tetrachloride forms corrosive reaction products more quickly than trichlorethylene and the vapors are more toxic.

Q. What are the prospects of depositing a uniformly thick layer of copper on a two-foot square mirror, over chemically deposited silver?

A. A thin deposit of acid copper, followed by a heavy deposit from the new high-concentration copper cyanide bath is recommended.

T. C. EICHSTAEDT, *Sec'y.-Treas.*



TOLEDO BRANCH

A regular meeting of the Toledo Branch of the A.E.S. was held at the country home of Mike Spanolis, on Nov. 3, 1938, with the following members present: Edward St. Arnand, Victor Miner, Stanley Moore, Mike Spanolis, James Gerity Sr., William Hunlock, Henry Schuldt, John Stegeman, S. C. Shank, Charles Adamski, Perin Sines, Walter Witkorowski, James Nagle Jr., Walter Weiker, G. Bergeman, William Whitaker, August Minke, and three visitors.

The meeting was called to order at 8:30 and Mr. Walter Weiker presided, at the request of the secretary, in the absence of the President, and the Vice President, at the time the meeting started. The minutes of the previous meeting were read and approved. The treasurer's statement was then read and

approved. A statement for Per Capita tax from the National Secretary was acted upon, and after a brief explanation by Mr. Weiker as to why the per capita rate had increased, for the benefit of those who did not already know, the bill was ordered paid.

At this time, Mr. Robert P. Milligan, and Mr. Lamoine Rutherford were introduced to all the members present. and their application for admission to the Toledo Branch of the A.E.S. was read by the chairman, a motion was made by Mr. Gerity to act on the applications as a group, rather then individually, this was seconded, and passed by the assembly.

The question of having speakers at the meetings then came up and after some discussoin, Mr. Miner agreed to arrange to have a speaker at the next meeting, who was to talk on rectifiers, and the secretary was ordered to get in touch with Mr. Johnson from the Belke Mfg. Co., and try to get him to speak on rubber lining for plating tanks at our January meeting. It was also decided at this time to discuss articles in the REVIEW at future meetings.

A very thorough and lengthy discussion was started at this time on degreasing, several very good questions on construction of machines, methods of operations, distilling, and how to separate water from the liquid were answered by Henry Schuldt, Victor Miner, and Stanley Moore, after which the meeting adjourned and refreshments were served.

GASTON BERGEMANN, *Sec.*

SPRINGFIELD BRANCH

The monthly meeting of the Springfield Branch A.E.S. was held at the Hotel Charles on Monday evening, October 24th. In the absence of the President the meeting was called to order by Mr. W. J. R. Kennedy.

The minutes of the previous meeting were read and approved. A communication from the chairman of the Asbury Park convention was read.

A motion was made and carried that a committee be appointed to investigate the possibility of preparing a paper for the 1939 convention at Asbury Park. Messrs. Hartshorn, Prouty, and Costigan were appointed to serve.

The application of M. J. Allen Ferguson was put over to the next meeting.

The applications for three prospec-

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tive members were acted on and turned over to the Board of Managers. They were: Arthur W. Wood, associate member, Westinghouse Electric and Manufacturing Co., Walter R. Clark, International Chemical Co., and Arthur A. Copp, active, Moore Drop Forging Co.

The nominating committee read their report which was accepted.

The following officers were elected for the coming year: President, Mr. John Costigan; Vice President, Mr. James Calvert; Secretary and Treasurer, Mr. D. S. Hartshorn, Jr.; Librarian, Mr. Frank Clark; Board of Managers, Mr. T. S. Stephenson, Mr. J. Mongeau, Mr. Arthur Copp.

The speaker of the evening was Mr. Clark of International Chemical Co. His subject was "The History and Application of Alkaline Cleaners". Mr. Clark traced the early history of the cleaner business up to the present time, explained the uses of the various ingredients of alkaline cleaners, and the difference in potash and caustic soda cleaners.

At the close of the discussion following this paper Mr. Clark was given a rising vote of thanks.

The meeting adjourned at 10:30 p.m.

D. S. HARTSHORN, JR., *Sec.-Treas.*

PHILADELPHIA BRANCH

Philadelphia Branch held its regular meeting at Hotel Warwick, Joe E. Underwood presiding. Roll call of officers—all were present. The minutes of previous meeting read and approved as read.

The applications of Albert Hagen, H. Clay Brubaker, Eugene Light, as active members, and Herman Jaffee as associate member were reported favorably by the Board of Managers. It was moved and seconded that the above applicants be accepted as members of Philadelphia Branch. A communication from Newark Branch Educational Committee was read. It was moved and seconded that same be received and filed. It was voted that the President appoint a committee to select a paper from Philadelphia Branch for the International Convention at Asbury Park, carried. The Banquet Committee reported everything in readiness for the biggest yearly Educational Session and Banquet Philadelphia Branch has held.

Our Librarian reported that Mr. L. A. Critchfield of Hamilton Watch Co., Lancaster, Penna., will present a lecture on watch parts. This should be very interesting. Also that Dr. A. Kenneth Graham of A. Kenneth Graham and Associates of Jenkintown, Penna., will present a very interesting lecture at our December meeting. Also Mr. E. A. Anderson of The New Jersey Zinc Co., Palmerton, Penna., will give a lecture in January, 1939. These are members of Philadelphia Branch. Come out and show your interest by your presence. The October meeting was well attended. There were 48 present. Moved and seconded, the members be notified that there will be a vote taken for selecting a meeting place. Either the Hotel Warwick or Harrison Lab., University of Pennsylvania, 24th and Spruce Sts., in the Quaker City Reminder in November issue.

The Librarian then introduced Dr. William Stericker of Philadelphia Quartz Co., whose topic was "Alkaline Detergents; their action on metals and their use in cleaning prior to Electrodeposition". He demonstrated by the use of slides a few of the principles involved. He also made a table demonstration, after which there was a very interesting discussion on same.

The meeting then adjourned until Friday, November 18, 1938, to be held at Hotel Warwick, 17th and Spruce Streets, Philadelphia, Penn., 8:00 p.m. sharp.

ROBERT E. JACKSON, JR., *Sec.-Treas.*

BRIDGEPORT BRANCH

The regular monthly meeting of the Bridgeport Branch was held in the Chamber of Commerce rooms at the Stratfield Hotel on Thursday evening, Nov. 3. There were twenty members present. Joe Sterling, called the meeting to order.

The roll call of officers was read and William Thompson of the Board of Managers was the only member unable to attend. The minutes of the last meeting were read and accepted.

Due to the fact that Dr. Walter Meyer had moved to White Plains, N.Y., the formation of the Chemistry Class has been postponed from the November meeting to the meeting of December 8. Mr. Clarance Helme will succeed Dr. Meyers as leader of this class, which will be open to all members and non-members at a fee of approximately $20.00 for twenty to thirty lessons. Further information can be had by communicating with Mr. Clarance Helme, 44 Austin street, Bridgeport, Conn.

The members were reminded to compile interesting papers on any plating information, and turn these in to the Committee between now and April, that they might be judged and prizes awarded. Besides the fact that they will prove of interest to our own members at local meeting, they may contain valuable information and those papers that gain First and Second Prizes will be read at the Convention in June.

The Treasurer's report was read and accepted.

Dr. Walter Meyer conducted the Educational Session, the theme of the evening was centered around Barrel Plating, which at the time seems to be a most interesting and popular subject.

Meeting adjourned at 10:00 p.m.

WM. H. FLAHERTY, *Sec.*

NEW HAVEN BRANCH

The meeting of the New Haven Branch was held Tuesday, November 1, at the Sterling Chem. Lab. of Yale University. A short business meeting was held, after which the members adjourned to a large lecture hall, where

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the monthly educational session was held. Mr. W. A. Helbig, assistant engineer of the Darco Corp., was guest speaker. Mr. Helbig gave a very interesting and informative talk on the use of Activated Carbon in Electro-plating solutions.

At the business meeting the following new members were elected:

Charles H. Canning, Active, 2133 E. Main St., Bridgeport, Singer Sewing Machine Co.

Lee Stevens, Active, 320 Cook Ave., Meriden, Conn., International Silver Co.

John Donaldson, Active, 26 Rowsley St., Bridgeport, Acme Shear Co.

James J. McTigue, Active, 1245 Chapel St., New Haven, New Haven Plating & Finishing Co.

Granville C. Fletcher, Active, 25 So. Burritt St., New Britain, Royal Typewriter Co.

The following member was dropped: Irving C. Eaton, Woodcrest Ave., Nichols, Conn.

The course in "Fundamental Principles and Theory of Electro-Plating" got under way Thursday, Nov. 10, at the Sterling Chem. Lab. This course, under the supervision of Tom Chamberlain and Professor Vance of the Yale faculty, will be held twice a month for the remainder of the year. Some fifty men, including members of other Conn. branches, and several non-members, have signed up for the course.

The next open meeting will be held Thursday, Dec. 6.

Jos. T. Sullivan, *Sec.-Treas.*

CHICAGO BRANCH

The regular monthly meeting of the Chicago Branch was held Nov. 12, 1938 at the Atlantic Hotel.

President J. W. Hanlon presiding and all other officers present.

Applications of A. G. Russell and A. Eder were balloted on and they were elected to membership.

Mr. H. A. Gilbertson, Chairman of the banquet committee reported that the arrangements for the annual banquet were complete and we expect to have the best of everything this year, including a fine dinner with entertainment all the time until the dancing is started.

Mr. O. Weickmann reported that the educational session was near completion and there will be some interesting papers.

Mr. O. Weickmann our librarian introduced Mr. W. H. Atkinson who was to take the place of Mr. F. G. Baechle, as he was unavoidably detained from appearing at the meeting to give his talk. Mr. W. H. Atkinson, of the Owens Corning Glass Co., Toledo, Ohio, gave a splendid talk on the "Manufacture and Uses of Fiber Glass" which was illustrated with moving pictures. This is a comparatively new subject and the members showed much interest in it. There were samples of fiber glass products exhibits after the meeting. Mr. Atkinson was voted a rising vote of thanks for his work.

The following questions were found in the question box.

Q. What causes die casts to blister under a rochelle salt copper plate?

A. Improper cleaning or etching or too low a temperature in the rochelle salt copper bath.

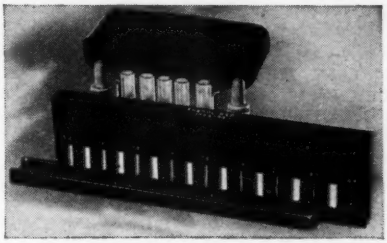
Q. How much nickel sulphate added to a cadmium plating bath will cause brittleness?

A. 1/10 oz. per gallon.

Q. What is a good brightener for a brass solution?

A. To two thirds of a gallon of the brass solution add about 2 oz. phenol ½ oz. copper bisulphide, 12 oz. sodium cyanide and 1/8 oz. arsenic. Use 15cc per 100 gallons of brass solution as needed. M. H. Longfield, *Sec-Treas.*

NEW pH SLIDE COMPARATOR



A new Slide Comparator for colorimetric pH control of both acid and alkaline plating solutions has been developed by W. A. Taylor & Co., 872 Linden Avenue, Baltimore, Md.

The new outfit is molded entirely from plastic. Radical changes in design have resulted in marked improvement in appearance, durability and ease of handling. The weight has also been considerably reduced. The pH values, as well as the indicator names, are engraved in white directly on the plastic slides. Improved catches are used to hold the top on the base and all metal parts are rustproof. The whole outfit, including the slide is 10 in. long, 2 1-8 in. wide and 4 in. high and weighs only 1½ lbs.

The new Comparator consists of a slide and a base. Each slide contains 9 color standards alternating with ampoules of distilled water. All color standards are guaranteed by the manufacturer to maintain their accuracy for a period of 5 years.

The base contains 2 vials of indicator solution, with 0.5 c.c. pipettes, 5-5 c.c. test tubes, and a piece of etched glass in a special compartment. Determinations are made by filling three of the test tubes with the test sample, adding 0.5 c.c. of indicator solution to the middle one, placing the slide on the base and moving it back and forth until the test sample matches one of the color standards. The pH value is then read off directly from the values on the slide. One base can be used with any number of color standard slides. Full information on these outfits can be obtained from the manufacturer.

A LETTER FROM A BROTHER IN DISTRESS

Dear Harold:

I don't know a thing about nickel plating. I never told you this before, so I suppose it's news to you, though I have a sneaky feeling that you knew it all along.

Also you may be surprised to know that I am still alive, as I have started to fool with stripping nickel from some pieces that went wrong. The books all have different formulas so I thought I made up one that was better. I took about a quart of nitric acid and put it in a gallon porcelain jar and added about a glass of muriatic acid, nothing happened. I then tied two of the pieces I wanted to strip to a piece of string and was all set to jerk them out before they were all gone, but, nothing happened. The nickel seemed to come off after about ten minutes, however, so I tried another lot. It all seemed so tame, and slow that I thought I would try a larger lot, and what was the use of tying a string on them. So I filled the jar full of pieces and walked up and down the room waiting for action; pretty soon they started to smoke, but as the others had smoked before the nickel was off I thought I would stir them in order to speed it up, well they got mad and started to

boil and smoke worse, so I tried to pick them out with the stirring rod, it didn't work, and they kept getting madder all the time and smoking worse until I thought I had better get them outside. I set the jar down on the cement just outside the door and then they really went into action. I couldn't see the jar any more due to the dark red smoke; in fact, I had difficulty seeing the building, which of course meant I had to give up trying to get them out, so I dumped the works over, and was thankful I could do that; then the cement started to boil. It all lasted only about 2 minutes so the neighbors had no chance to gather. Next time (Yes, I am afraid there will be a next time, unless I learn something about nickel plating) I will have them on a string. My chest don't feel as though I had t.b. any more, so I suppose I can say I got away with it.

Now about that plating—I have run quite a few heads and they always come out good, but whenever somebody brings in a few pieces with a little different shape and different bulk I get into trouble. Flat pieces lay against the side of the barrel and get spotted from the current coming through the holes in the bakelite. For the heads we always use all the current we can generate, so I tried the same amount when plating some covers with greater bulk. They came out green, orange, blue, yellow and about every other color. Also I tried to run them longer, in order to do a good job and get on lots of nickel. They came out with nickel hanging all over them and away from them This was the lot I had to strip. Also I tried running them on hot days since the books say so much about the temperature of the solution, and now the temperature is dropping and I am learning something about plating all over again. I am beginning to understand that temperature, time and current are sort of balanced against each other. But how am I supposed to know what the balance is, and then on top of that the pieces are always of a different shape, which also seems to want some sort of balance.

Generally my troubles come from trying to speed up the work, as with only one tank to operate, and prices based on efficiency, we have to put them through in the least possible time. Whenever, someone comes in who has had experience with barrel plating they tell me that they run about twice the amperage that I do and plate in about half the time.

I have tried to get the answer to this from the book, and the only thing I can find is that we used no ammonium salts. I am beginning to wonder now if these ammonium salts would not make it possible to use higher current without burning the work. My objection to putting in ammonium salts was that the books all seemed to say that it would slow down the plating due to lower solubility. I was wondering if a very small amount would have any effect at all (say ¼ oz/gal) or would you have to put in the amounts mentioned in the books (2 oz/gal) before it would take effect. Also I have seen in several books that they mention that Nickel Flourite insures all the nickel from the anodes going into solution instead of falling to the bottom of the tank and being lost in the sludge; and speaking of sludge I understand that the solution should be filtered every so often. Oh there are lots of things I don't know about plating. About this Nickel Flourite, wouldn't it be a good idea to put in just a little of this too? Then after a while we would have a solution with about forty things in it and have a really tough problem for some of you chemists. I wish I knew something about it myself. The books say to put in Hydrogen Peroxide to prevent pitting; I don't even know what pitting looks like. What to do to prevent my hot water from getting all rusted up. The anodes are corroding so good that the pH increases, but the metallic nickel of the solution keeps going down unless I add Nickel Salts; I can't make this jibe with the book.

I have a lot more questions to ask too, but first I must learn what they are.

I hope to learn something about nickel plating.

Very truly yours,

JOE

Anodic *or* Cathodic? Which *and* Why?

One of the many operations in the plating department which has always caused considerable controversy is the title of this article. This is by no means a technical paper, but rather, the observations of a practical plater covering several years' experience in varied lines of manufacturing products.

Anodic or Cathodic? or in the language of the plater, Straight or Reverse? This has always seemed to me to be one of those problems that require a very definite reason to favor either one or the other, (or both) of these applications and I feel there is a definite reason to favor the reverse in the always present danger of deposition when using the so called straight current method of electric cleaning.

In this type of cleaning (Cathodic) the positive current is usually wired direct to the steel tank and the parts to be cleaned are of course the cathode, in this set up which is recommended to be operated at boiling temperatures, we have a highly efficient plating unit, very high in conduction, into this tank we put everything the average plating department is called upon to plate, and this is generally speaking, anything that happens to be made of metal, any kind of metal, these parts are usually covered with some kind of dirt or oil and in the cleaning process this dirt and oil and sometimes part of the cathode itself becomes a definite part of the high speed electrolyte, any organics thus decomposed will at certain concentrations (these concentrations are very low as witness the very small amounts of CuCN necessary to obtain a copper deposit in a cleaning solution) plate out on to the cathode in the form of oxides which we assume are subsequently removed by reversing the current for a few seconds and the use of the acid dips which are a part of every cleaning cycle. There are, however, quite a number of these oxides or films which are not removed by these methods, about a year ago, a cleaner manufacturer published an article on these films calling them hydrophilic. It was pointed out that these films not more than .000001 inches thick could not be removed by the usual methods but no deposited metal would ever stick to them.

The new bright nickel solutions are extremely critical of the preparatory cleaning before plating due perhaps to the surface tension of these solutions.

There are of course a few precautions which should be observed when cleaning with the reverse current; that is, using the part to be cleaned as anode.

Where high currents are used (over 6 volts) with a weak cleaner concentration etching of the part will sometimes occur. This is of course disintegration of the anode, the anode in this case being the part to be cleaned.

It would seem that a control method could be worked out to remedy this as there appears to be a more or less definite efficiency limit or ratio of the strength of the electrolyte to the anode. However, the many kinds of cleaners in every day use with their hundreds of formulaes make it difficult to develop any standard control.

In a very excellent paper prepared by the Dayton Branch of the A.E.S. on metal cleaning, it was shown that the original formula of a cleaner was never maintained during its use.

There certainly is a real need for more accurate control of cleaning solutions. Platers are surely entitled to some accurate method of determination other than an end point showing how many ounces there are in each gallon of solution.

It seems to be true that strengthening of the cleaner concentration stops the etching.

It appears that polished parts will be attacked much more readily than unpolished. This is probably due to the surface structure being changed

in the polishing operation. A few unpolished parts hung in the tank with the polished ones will nearly always stop the etching.

There are no other objections to the use of the reverse current that I have run into, nevertheless, there may be a few technical reasons why the straight current is the best and most efficient way to clean electrically. If so, I trust this will be answered.

GEORGE SIMMONS.

CHICAGO BRANCH

27th Annual Banquet and Educational Session

To be held Saturday, January 28, 1939

at The Palmer House. The Educational Session will be held from 2 to 4.30 P. M. The Banquet will be held in the GRAND BALL ROOM at 7 P. M. sharp. Tickets are $3.00 each and can be secured now from the Secretary, M. H. Longfield, 1158 S. Mason Ave., Chicago, Ill.

CHICAGO BRANCH BIDS YOU A HEARTY WELCOME

GRAND RAPIDS BRANCH

Educational Session and Dinner

DECEMBER 9, 1938

Speaker:

H. W. KENNEDY of the DUPONT CO.

Subject:

"RAPID COPPER PLATING"

Dinner at 6:30 P. M. **Tickets $1.50 Per Person**

FRANK E. TERRIO

Obituary

Mr. Frank E. Terrio was born in Dorchester, Wisconsin, December 5th, 1879. He was of French-Canadian parentage, and one of a large family. Mr. Terrio died October 31, 1938.

When 17 he worked as a plater's helper, and then held several plating jobs in and around Chicago. Mr. Terrio was then successful in obtaining employment as a salesman with the E. Reed Burns Company in their Chicago Branch. In a short time he was made Branch Manager to this company, and was with them in that capacity for approximately fifteen years, during which time he traveled in Wisconsin, Iowa, Illinois, Missouri, Indiana, Michigan, and occasionally into Ohio. The branch flourished under his management.

In 1919 Mr. Terrio and two other men started the St. Louis Platers' Supply Company, where they manufactured buffing compositions, buffs, and polishing wheels, and this was the first buff factory west of Utica, New York. In later years the name was changed to Lasalco, Inc., and the original partners in the business sold out their interest to Mr. Terrio and Mr. Hedley J. Richards, who is now retired. In 1927 and 1928 the company started in the manufacture of plating barrel equipment, burnishers and other types of equipment in the electroplating and polishing fields, and under Mr. Terrio's able leadership,

the company has steadily progressed. Although comparatively a young man, Mr. Terrio has probably had as many active years on the road as any other salesman in the industry.

Mr. Terrio's body was laid at rest in Oak Grove Cemetery outside St. Louis on Thursday, Nov. 3. The full Masonic ritual being used. Prominent members of the A.E.S. who attended the last sad rites were Messrs. Manderschied, Glen Cameron, R. M. Leather, Mr. Reynolds, A. G. Spencer, Frank J. Hanlon, H. Williams, E. J. Musick, H. Richards, and Burton G. Daw, business partner of the deceased. Many well known St. Louis business men also attended.

Mr. Terrio was one of the mainstays of St. Louis Branch, A.E.S., and a member of Webster Lodge, No. 84, A.F.&A.M. His death will be keenly felt by both organizations.

We convey our sincerest sympathy to his widow and daughter, Mrs. Irene Crabb, in their time of sorrow and bereavement.

SOME PERTINENT REMARKS FROM CHICAGO

In the first place I want to congratulate you on the publication of the Convention Proceedings. It is mighty well edited and should be a treasure to anyone engaged in the industry. Another thing it is "hot off the griddle".

Now in the second place there is another feature for congratulations to you on the good job you are doing with the REVIEW, and most of us should be ashamed for not helping you more. My urge to write this letter is your editorial in the October issue. May I make a few suggestions to help the REVIEW? Why don't you appoint a reporter or in other words a "news hawk" in each branch to send in a report of business conditions, who's changed jobs and where, who's sick, any new material or methods used in plating, additions, change of address, etc., of industries, etc., etc. I believe the REVIEW could be made most interesting from a personal as well as an educational and instrumental standpoint.

Care should be used in selecting someone who will be devoted to reporting. The branch secretary has a lot of work to do regularly and it is difficult to add personal reporting to his work. That is why I suggest your appointing someone to take care of the news details.

At our educational session preceding the Annual Banquet, January 28, next, we will have a public stenotypist to take down all discussion so that Oscar Wieckmann, our Librarian, can send in a real report of the session.

I have just rambled on here, and if I have written anything that will help you I am pleased. Also if I can do anything to help just let me know and I will gladly comply. Very kindest regards and best wishes for your continued success.

NOTICE

After November 1, 1938, Platers Research Company will be located at their new and larger quarters with laboratories and offices at 59 East 4th St., New York. Telephone Orchard 4-1778.

A LETTER FROM THE CHAIRMAN OF OUR RESEARCH COMMITTEE

Several suggestions have been offered as to the program for future Research work at the International Bureau of Standards. A tentative outline was offered at the Milwaukee Convention and adopted by vote. This program is not binding upon the present Research Committee and therefore can be changed in any manner. At the meeting of the Committee on Sept. 16th in New York City there was a general discussion, not only of the outline offered at Milwaukee but also of other problems. Some comments have been made that no definite program was decided upon at that meeting. It is for this reason that this letter is being sent so that a clear picture can be had of the

relations of the A.E.S. and the International Bureau of Standards as to the investigation of any problems by the A.E.S. Research Association.

It must be realized that this research is co-operative. The National Bureau of Standards contribute in supervision, equipment, supplies and in many other ways a sum that is equal in value to the amount that is contributed by the A.E.S. It is, therefore, not possible for the A.E.S. to dictate what subjects shall be adopted for research work. Whatever subjects are offered by the Research Committee must be submitted to the Bureau of Standards for their consideration. If any change is desired or if any entirely new outline of research be instituted that is entirely a prerogative of the Bureau of Standards.

In the past those at the Bureau of Standards who make the decisions regarding this work have been exceedingly liberal towards the suggestions of the A.E.S. In fact it is probably due to that very fact that it has come to be believed by many that the A.E.S. can select and direct any research that may be decided upon by the Society at a Convention or the Research Committee.

A statement of the policy of the Bureau of Standards is in order and it is regretted that this has not been made previously so that it would not be necessary to bring this matter up at this time.

1. *Selection of Subjects.*

The A.E.S. can suggest subjects for research but the investigation of any problem must be in agreement with the wishes and policy of the Bureau. Co-operation, as far as possible, avoiding all commercialism, is given to all proposed research problems. The Bureau is handicapped by the increased use of proprietary plating solutions. It cannot state any definite conclusions as to the value of any specific process.

2. *Nature of Work.*

The Bureau wishes that all work be of a scientific nature. It is against the policy to compete with commercial laboratories. No commercial tests can be made for publication or for comparative purposes.

3. *Results of Research.*

The results of all research work will be submitted to the A.E.S. but must be approved by the Bureau which reserves decision as to when and where these results be published. If the work is done in co-operation with the A.E.S. Research Associate then the paper will be published under joint authorship. It is not possible to publish progress reports of incompleted research work. The status of a research can be reported but no detailed data are available for publication. The Bureau objects to publishing results piecemeal and insists that the research be completed before given to the public.

4. *Direction of Research Associate.*

The A.E.S. Research Associate is under the supervision of the Bureau Staff. He is governed by the rules that apply to all employees of the Bureau. The direction and supervision of his work by the A.E.S. must be through the Director of the Bureau of Standards.

From the above a clear understanding of the A.E.S. research work at the Bureau can be had. It can also be seen that while it is perfectly correct for members of the society or members of the Research Committee to request that certain problems be investigated, that it is not always possible to comply with the requests.

As stated above the A.E.S. has been most fortunate in the co-operation given by the Bureau of Standards. This is due entirely to the efforts of Dr. William Blum. He alone should be given credit for the splendid co-operation of the past and for his patience and forebearance in the face of criticism from many of the A.E.S. members.

Your chairman of the Research Committee has had a discussion and a thorough understanding of the relations between the A.E.S. and the Bureau of Standards and will be governed accordingly.

Your hearty co-operation is earnestly requested.

Yours very truly,

GEORGE B. HOGABOOM.

Research Department

PROGRAM OF RESEARCH BY THE RESEARCH ASSOCIATE OF THE AMERICAN ELECTROPLATERS' SOCIETY AT THE NATIONAL BUREAU OF STANDARDS

I. Introduction

During the past several years the American Electroplaters' Society has maintained a Research Associate at the National Bureau of Standards to conduct studies on electroplating problems. The principal subject has been the protective value of electroplated coatings. Atmospheric exposure tests of steel plated with known thicknesses of (a) nickel and chromium, (b) zinc, or (c) cadmium, were conducted in six locations in co-operation with the A.S.T.M. The results were published in NBS Research Papers 712, 724, and 867; and were used in the preparation of tentative specifications that were adopted in 1935 by the A.E.S. and A.S.T.M.

In 1936 and again in 1938, specimens of brass and zinc-base die-castings, plated with known thicknesses of nickel and chromium, were exposed in these six locations, and have been inspected at intervals by the Joint Committee and other interested persons. As soon as definite conclusions are reached from these tests, they will be published and will be incorporated in appropriate specifications.

II. Further Needs

The principal requirement in most present specifications is the quantity of the deposits, defined in terms of either their minimum or average thickness. The question has been raised as to what factors other than thickness may affect the protective value of the plated coatings. At a meeting of the A.E.S. Research Committee in Milwaukee in June, 1938, the following specific topics were recommended for study and were later approved by the A.E.S. Convention.

1. Do mechanical forming operations affect the continuity and protective value of coatings subsequently plated on steel and brass?
2. Do methods of polishing, cleaning, and pickling various metals influence the protective value of the coatings?
3. What effects do the shape of articles and their positions in the plating tanks have upon the distribution and protective value of the coatings?

III. Research Conference

Following a regular inspection of the exposure tests in New York on September 16th, a meeting of the Research Committee and other interested persons was held to discuss the program for research for the present fiscal year. About 35 persons were present, including 18 of the 23 members of the Research Committee. Various phases of the proposed program were discussed in detail. In addition, certain other subjects for research were suggested both during this conference and in letters received before and after the meeting.

Among the suggestions regarding the three topics above listed were the following:

1. *Effects of forming operations.* In the tentative outline, it was proposed to plate steel or brass specimens that had been deformed by stretching or bending, and to test them for porosity and in accelerated tests, followed by exposure tests of certain specimens. The following suggestions were also made:

(a) Laboratory tests may be misleading, hence no conclusions should be reached without also including exposure tests, at least in the more severe locations.

(b) In the deforming tests, all factors, including stretching both longitudinally and transversely, should be included.

(c) Various types of steel should be included.

(2) *Effects of polishing, cleaning, and pickling.* In the outline, it was proposed to start with steel having a good finish and then produce different types of finish by the application of suitable grades of abrasive. The following additions were suggested:

(a) Use some device for obtaining a constant pressure in the polishing operations.

(b) Prepare some base metals with the most perfect surfaces possible, to serve for comparison.

(c) Determine the effects of separate alkalis in cleaning mixtures.

(d) Determine the relation of the cleaning mixtures to the composition of the polishing compounds to be removed.

3. *Effects of shape and position.* It was proposed to have certain typical shapes plated in commercial plants under normal conditions, and similar specimens plated in the laboratory with controlled spacing, and in each case to determine the distribution and porosity of the coatings. In addition, the following suggestions were made:

(a) Include effects of air and mechanical agitation upon metal distribution and porosity.

(b) Determine the effect upon porosity of filtering the solutions.

Among the other problems suggested for study are the following:

4. The adherence of deposits and the effects of variations in preparation and plating upon adherence.

5. Plating of metals for use in subsequent forming operations, including the ductility of deposits and the avoidance of embrittlement of the base metal.

6. The measurement of stresses remaining in plated coatings.

7. Throwing power, its measurement and improvement.

8. Methods of stripping defective deposits.

9. Neutral and alkaline baths for plating nickel on zinc and aluminum.

10. Wetting agents for use in cleaning baths and in plating baths.

11. Effects of pH in bright nickel plating baths.

12. The efficiency of various rack coatings.

There was no opportunity for full discussion of all of these subjects, some of which were proposed after the meeting. Certain of them are entirely practicable, and will be given careful consideration in the extension of this work. Others involve materials or processes that are at present secret or proprietary, upon which it is difficult to conduct adequate studies and to publish reliable and useful conclusions.

IV. Program Adopted

The conference approved the study at this time of items 1, 2, and 3, with such additions or modifications as were discussed, or as appear warranted in the course of the investigation. It should be recognized that much of this work is necessarily exploratory, in order to learn whether any given effects are appreciable and what range of experiments is necessary to yield significant results. Whenever definite, even though tentative, conclusions appear warranted, they will be published. At least a year will be required, however, to obtain even fairly complete answers to the first three problems. In the meantime, the chairman will be glad to receive suggestions regarding (a) the program in progress, (b) the relative importance of the other subjects listed, and (c) still other ways in which the A.E.S. through the Research Committee, can be helpful to the plating industry.

G. B. HOGABOOM, *Chairman*,
Research Committee, A.E.S.,
557 Stanley Street,
New Britain, Conn.

W. BLUM,
National Bureau of Standards,
Washington, D. C.

The Abstract Section

FREDERICK FULFORTH, *Chairman, Program and Educational Committee*

Anodic and Ordinary Corrosion of Ferrous Metals in Acids. By RAYMOND R. ROGERS and EDGAR BLOOM, Jr. *Trans. Electro-chemical Society*, **74**, (preprint 22) (1938). The loss of weight of six metals in HCl, H_2SO_4, HNO_3, and H_3PO_4 was determined at various temperatures and concentrations, both with and without anodic current (72 amps/sq. ft.). Corrosion was severest with current. With many exceptions, high temperature and concentrations of 12 *N* produced the worst corrosion. Duriron and durichlor were by far the most resistant alloys; HCl and H_2SO_4 durichlor was somewhat superior, but duriron was preferable with current. 18-8 chromium-nickel stainless steel was somewhat superior to ordinary steel (cold-rolled, low-carbon in HCl and H_2SO_4, except in hot concentrated H_2SO_4. Though 14% chromium iron was severely attacked by HCl and H_2SO_4, as was silcrome RA at 140° F., both metals were comparatively resistant to anodic current in H_2SO_4. In HNO_3 and H_3PO_4, only ordinary steel was much attacked. Anodic corrosion rates were inversely linear to average cell voltages.

ERNEST H. LYONS, Jr.

The Adherence of Thick Silver Plate on Steel. By F. C. MATHERS and L. I. GILBERTSON. *Trans. Electrochemical Society*, **74,** (preprint 30) (1938). 14 pp. illus. Silver electrodeposits 0.05-0.07 in. thick on steel were tested for adherence and hardness. Adherence usually decreased as the plate became thicker but was improved by annealing. A copper or silver strike was essential for good adherence, although the plating bath did not deposit silver by immersion. Even copper-clad steel required a silver strike, while tin plate required heat treatment regardless of the strike. A 2% gelatin dip (Thum and Mulligan, U. S. Patent 1,283,973) instead of strike was fairly effective. If the cathode was not completely covered in the strike, adherence was obtained in spots only; too long a strike gave loose, spongy deposits which blistered on annealing. The cathode must be connected before immersion in the strike, and c.d. must be sufficient to cause gassing. The copper strike was less critical. No advantage was found in using both strikes. Recommended formulas:

Copper strike

Basic copper carbonate	3.7 oz/gal
Sodium cyanide	7.65 "
Sodium carbonate	0.35 "

167° F., c.d. 47 amps/sq. ft., 15 sec.

Silver plate

Silver cyanide	3.5 oz/gal
Potassium cyanide	6.2 "
Potassium carbonate	5.0 "

Room temp., c.d. 3.7 amps/sq. ft. with filtration and gentle stirring.

Silver strike

Silver cyanide	0.25 oz/gal
Potassium cyanide	2.40 "
Potassium carbonate	0.43 "

Room temp., c.d. 55-175 amps/sq. ft. 1-5 sec. depending on the steel.

Optional silver plate

(*Metal Industry*, **35**, 337, (July, 1937))

Silver nitrate	4.0 oz/gal
Sodium cyanide	4.0 "
Potassium nitrate	16.0 "

You Can Make A 75% SAVING

in the Time of Cyanide Copper Plating

by using the NEW Du Pont

HIGH SPEED COPPER

• PROCESS •

HEAVY coatings—0.001" to 0.002"—in 10 to 20 minutes at 100% cathode efficiency! And on a steel rod, a 0.034" deposit in 2½ hours, plated at 125 A/SF, an unusual thickness for cyanide copper. These results are typical of the speedy cyanide copper plating which can be obtained with this new and different process.

The deposits are uniformly bright, free from pits and other imperfections—excellent surfaces for direct deposition of bright or dull nickel. The deposits can be easily buffed because of uniformity and fine grain structure.

For some articles, such as printing rolls, wire, rods, the process can be adapted to a current density of 100-200 A/SF. Smooth deposits of copper can be built up rapidly.

The du Pont High-Speed copper plating process can be installed in usual cyanide plating equipment. The solution is readily prepared from pure compounds, which are completely and readily soluble in water. The same chemicals are used for maintenance and replenishment.

CONSIDER THESE ADVANTAGES:

★Bright lustrous deposits on steel and die-castings.

★High Speed Plating—about 4 times as fast as present commercial practice.

★Heavy coatings—up to 0.033" or more.

★Soft, fine-grained deposits which can be easily buffed.

★100% efficiency at the Cathode, up to 60 A/SF.

★100% efficiency at the Anode, up to 30-40 A/SF.

★No Pitting.

★No hydrogen or noxious fumes.

★Negligible cyanide decomposition.

★No sludging or polarization of anodes.

★Simple Control.

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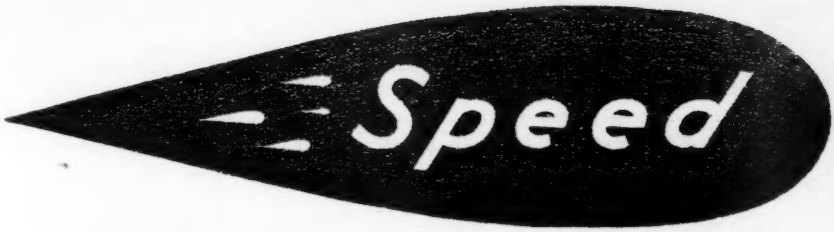
A perchlorate bath gave brittle deposits. The crystal structure of the steel was not continued in the electrodeposit. Before plating, the steel required degreasing and an acid dip of 15-40 sec. in 10% hot hydrochloric, sulfuric, or acetic acids. For steel with more than 0.1% carbon, anodic cleaning in 80% H_2SO_4 or cathodic cleaning in 10% HCl or H_2SO_4, c.d. 186 amps/sq. ft., was preferred. Shot blasted steel required less time in the acid. The acid removed oxide films and left open cracks for mechanical adherence. The hardness (Vickers) of .024" silver plate was approximately that of cast silver (.020") on a commercial steel-backed bearing. Both were harder than pure annealed wrought silver or cast ingot silver. Annealing affected some softening. ERNEST H. LYONS, Jr.

Electrodeposition of Silver Alloys from Aqueous Solutions. By FRACK C. MATHERS and AARON D. JOHNSON. *Trans. Electrochemical Society*, **74,** (preprint 27) (1938). 21 pp. Alloys of silver with copper, nickel, iron, cadmium, zinc, cobalt, and lead were deposited from various baths (mostly thiourea, thiocyanate, or nitrate-tartrate solutions). Operating conditions, compositions of baths and alloy plates, hardness, adherence, etc. were studied. Cyanides were used only in the lead-silver baths, which gave the most promising deposits for bearings. The alloy plates, except cadmium, zinc, and iron, tarnished more readily than pure silver.

ERNEST H. LYONS, Jr.

Effect of Solution Concentration in Electrodeposition of Manganese. By S. M. SHELTON and M. B. ROYER. *Trans. Electrochemical Society*, **74,** (preprint 33) (1938). 11 pp. Outline of work done under the Bureau of Mines, U. S. Department of the Interior, to develop a domestic supply of manganese. (Of interest to electroplaters as a new application of electrodeposition to make the United States independent of foreign sources of this strategic metal. Domestic ores are adequate but unsuited to customary refining processes. A manganese industry and manganese plating are potentialities.—E. H. L., Jr.) Manganese may be dissolved from American ores by sulfurous or sulfuric acids and electrodeposited if sufficient ammonium sulfate is present. Some success has been attained in pilot plant operation. The conductivity and heating of the solution is not much dependent on ammonium sulfate concentrations above 16.8 oz/gal if the c.d. is less than 28 amps/sq. ft. ERNEST H. LYONS, Jr.

A Volumetric Process for the Determination of Cobalt and Nickel in Presence of One Another. By B. S. EVANS. *J. Electrodepositors Tech. Soc.*, **14**, preprint, 8 pp. (1938). Nickel and cobalt are determined by two cyanide titrations similar to the standard cyanide titration for nickel. In the first titration both nickel and cobalt react. The titration is performed by running in excess of standard KCN and back-titrating with standard $AgNO_3$. The volume of KCN consumed is equivaleent to the total amount of cobalt and nickel present. A second titration is performed to determine the nickel alone. The cobalt is converted to the inert cobalt-cyanide by boiling with KCN,



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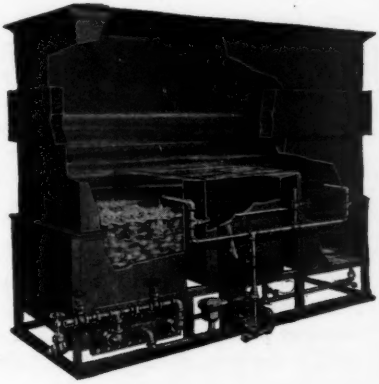

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the excess of which is afterwards destroyed by H_2O_2, and the titration performed as before. The volume of KCN solution used gives the amount of nickel. The difference between the first and second titration gives the amount of cobalt. Copper, iron and aluminum interfere with this method and must be removed. A. BRENNER.

The Present Position of Bright Nickel Plating in England. By N. R. LABAN. *J. Electrodepositors Tech. Soc.*, **14**, preprint, 8 pp. (1938). The following three bright nickel baths are discussed:—(1) Schlotter; (2) Weisberg-Stoddard Co-Ni bath; (3) Hinrichsen Co-Ni bath. The advantages of bright Ni are:— (a) time saving in unracking and reracking between Ni and Cr plating. This permits the introduction of fully automatic Ni and Cr plating; (b) bright deposits can be produced on contoured work and in recesses which would be difficult to polish; (c) saving of the thickness of deposit normally removed in buffing and elimination of the risk of cutting through the deposit on sharp edges. The operating conditions of the baths are given. Both the Weisberg and Hinrichsen baths contain sodium formate as brighteners, but the former contains formaldehyde in addition. A. BRENNER.

Automatic Bright Nickel and Chromium Plating. By J. KRONSBEIN: *J. Electrodepositors Tech. Soc.*, **14**, preprint, 6 pp. (1938). A compact automatic plating plant is described. The entire sequence of cleaners, rinses, acid dips, bright nickel and chromium plating occupies a space of only 8 x 50 feet. The rapid transfer of the work from one tank to another is important in order to prevent staining and drying. This is accomplished by the "duplex carriage system", which consists of two carriages, one above the other, moving on separate tracks. The work bars are attached to the carriages by a system of belts and pulleys, so that the motion of one carriage relative to the other raises or lowers the work bars. The conveyor chain travels only 6-12 in./min., but the carriages move faster and work is transferred from one tank to another in 20 seconds. Bus bars are of pure aluminum. The operation of the baths at high current density permits the use of small tanks. The nickel tank is 8 feet long and the current density used is 50-80 amp/ft^2. The chromium tank is 5 feet long. The bright cobalt-nickel plating bath is used. The anodes are of electrolytic nickel, because with cobalt-nickel alloy anodes, the cobalt dissolves preferentially, leaving a sponge of nickel. Cobalt is added to the bath in the form of sulfate. 3.5 million door handles are plated per year and rejects are about 4 percent. A. BRENNER.

Bright Nickel Plating of Zinc Base Die-Castings. By S. WERNICK. *J. Electrodepositors Tech. Soc.*, **14**, preprint, 5 pp. (1938). Bright nickel cannot be plated directly on zinc because of deleterious effects of small quantities of zinc in the bath. Zinc articles are first copper plated. Bright copper deposits are not necessary as an undercoat and have the disadvantage of being brittle. Matt copper deposits will serve if they are smooth and fine-grained. The following is a typical bath:— CuCN, 3.5 oz/gal.; Na_2CO_3, 2.5 oz/gal.; Rochelle salts, 6 oz/gal.; free cyanide 0.75-1.25 oz/gal.; current density, 60-80 amp/ft^2;

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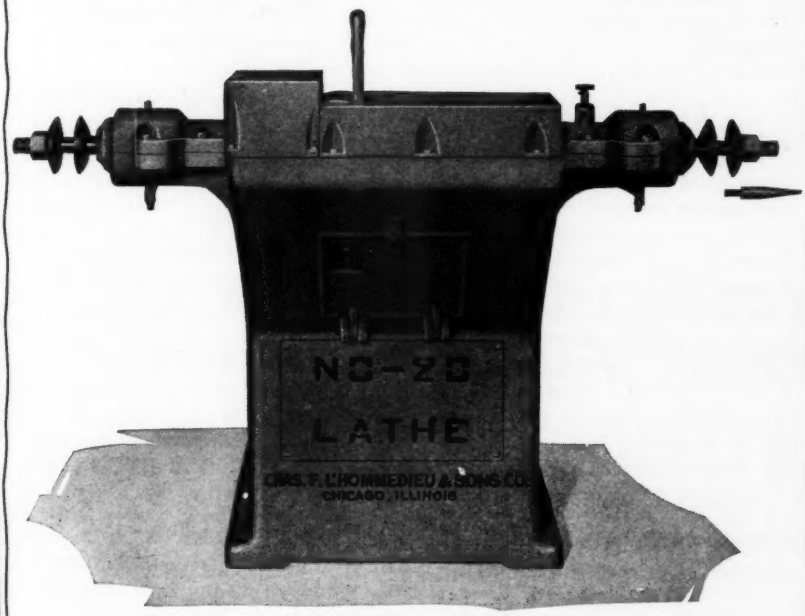

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pH, 11.6-12.3; temperature, 140-160°F. After plating, the article is rinsed in dilute H_2SO_4, then in water and transferred to the bright nickel bath. The cobalt-nickel bath gives good results, but it is sensitive to small amounts of impurities. Iron should be less than 0.05 percent, zinc, copper, or lead should not exceed 0.001 percent. The effect of impurities is first noticed by the dullness of the deposit on low current density areas. Methods of removing impurities are: (1) precipitation by raising the pH; (2) electrolysis at low current density (1-5 amp/ft.). Racks used for chromium plating should not be used for Ni plating because of the danger of carrying CrO_3 into the nickel bath. Bagged electrolytic nickel anodes are best. The bath is best contained in a rubber-lined tank; it is air agitated and continuously filtered.

A. BRENNER.

Bright Zinc Plating. By R. SPEARS. *J. Electrodepositors Tech. Soc.*, **14**, preprint, 4 pp. (1938). Because of the high price of cadmium, bright zinc plating has replaced cadmium plating for many purposes. The bright zinc baths are cyanide baths to which have been added either organic addition agents or some inorganic substances such as Hg or Mo. These baths are not as successful as the acid sulfate bath for plating grey cast iron or malleable cast iron. The baths may be operated at a current density from 5-100 amp/ft^2 and at a temperature from 20-50°C. In some cases the zinc coating may be brightened after plating by immersion in one of the following dips:—(1) 0.25-1.0% HNO_3; (2) H_2O_2 and H_2SO_4; (3) CrO_3 and H_2SO_4. The dip removes about 10 percent of the coating. Small amounts of Cu, Cd, Sn, As, or Pb in the plating bath cause dull or stained deposits. These impurities may be removed by working the bath at 20 amp/ft^2. A. BRENNER.

Experiences in Bright Nickel Plating. By J. G. ROBERTS. *J. Electrodepositors Tech. Soc.*, **14**, preprint, 1 p. (1938). The Weisberg and Hinrichsen Co-Ni baths are discussed. Care must be used in wiring and racking objects as unsatisfactory deposits are obtained at contact points. For filtration of the bath, a bronze pump internally Cr plated is used. Keiselghur candle filters operate well when new, but they become less pervious with use and are difficult to clean. Cotton cloth anode-bags are quickly attacked. A woolen cloth would be more durable. Nickel formate crystallizes on the anode bags sometimes insulating them from solution. A. BRENNER.

Barrel Finishing of Metal Products. By H. LEROY BEAVER. "*Product Finishing*", Oct. 1938, pp. 56-63. Article 18 on barrel finishing concerning surface hardening in a barrel to resist wear and corrosion. Polishing does not work harden surface to same degree as barrel burnishing. In burnishing it is surface pressure and not rolling that produces surface flow and subsequent "cold working" of surface of piece. Also, this flow tends to flow metal over pores and thus improve the sealing effect of coating. Degree of surface hardness depends on weight of balls and load and type of barrel. Formed burnishing material gives better results than round balls. Gives chart of softness plastic metals which decreases in following order: lead, silver, gold, tin, copper,

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Gold	Copper	Iron
Zinc	Tin	Copper
Silver	Lead	Gold
Copper	Zinc	Zinc
Platinum	Platinum	Tin
Iron	Iron	Lead

PHIL J. RITZENTHALER.

METALS AND ALLOYS ABSTRACTS

Materials of Construction for Electrodeposition Plant. By A. I. WYNNE WILLIAMS. "*Metal Industry*", London, Vol. **52**, May 27, 1938, pp. 557-60. General discussion of materials suitable for plating plant construction with regard to cost, structural suitability and corrosion resistance. Due to manufacturing difficulties, sizes and shapes of special corrosion resistant alloys are restricted. In dealing with corrosive liquids, joints must be perfect. This is true also in protecting cables and electrical apparatus. One of the biggest troubles arises from corrosion due to stray currents. Metallic parts in contact with electrolyte should be insulated wherever possible.

Steel is widely used due to high strength and ease of fabrication, but is poor from the standpoint of corrosion resistance. Concrete will crack, is difficult to repair and is attacked by acids. Use of rubber lined steel tanks is increasing. Lead lining still used due to ease of manufacturing, but difficulties encountered due to stray currents. Clad metals, such as nickel-clad steel, are also used to some extent. PHIL J. RITZENTHALER.

Corrosion Protection of Electrolytic Deposits. By M. SCHLOTTER. "*Oberflachontech*", Vol. **15**, July, 1938. Original research. Experiments were made to show relation between nature of base metal surface and porosity of metallic deposits on it. Roughness was determined with photocell and reflectometer. Porosity was tested by immersion in a solution of 2% ammonia plus 1% ammonium persulfate for 10 min. Amount of metal going into solution taken as measure of porosity. Porosity increases with increase in roughness; thicker deposit does not materially change porosity. Good corrosion protection requires previous preparation of surface.

PHIL J. RITZENTHALER.

Use of Phosphoric Acid in Steel Pickling. By H. B. FOOTNER. "*Iron and Coal Trades Rev.*", Vol. **137**, July, 1938. Method of pickling, including immersion in hot 10-15% phosphoric acid, followed by dip in bath containing 2% free phosphoric acid at 85°F., with 0.5% dissolved Fe, was developed. The latter was made from spent first bath by diluting with water. The second rinse removes strong acid and leaves a film of iron phosphate

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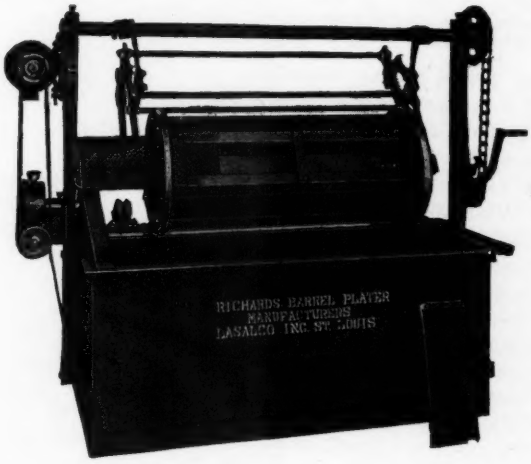

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which prevents rusting in stock. Also excellent for painting. To cut cost some sulfuric may be used in first bath. PHIL J. RITZENTHALER.

Attacking Trade Waste Problems. By G. M. DARBY and C. L. KNOWLES. *Chemical and Metallurgical Engineering*, October 1938. Modern sanitation regulations and economical reasons are necessitating reclamation of industrial wastes to a greater extent than ever before. In meeting their problem, the management is faced with the questions: "How shall we treat our wastes? What will be the cost? Can valuable by-products be recovered?"

Many valuable by-products such as fuels, fertilizer base, animal feed, insulation, grease and metals are now being reclaimed. The principal methods used in reclaiming are crystallization, filtering, centrifuging, oxidizing, and chemical action. Pickling liquors are being converted into Ferrous sulphate, sulphur, sulphuric acid, ferric oxide and insulation. The manufacture of Ferron, the new insulation material provides for the treatment of pickling liquors. It consists of treatment with lime in precipitation tanks under controlled pH and temperature so as to yield a thick slurry. Precipitate is filtered, pressed, disintegrated and dried. Most industrial wastes change rapidly with the passage of time and therefore react quite differently after a few days storage. This is particularly true of those wastes containing organic matter. Hence investigations should be conducted in the field on fresh samples, composited from at least a day's flow. Preliminary studies made at distant laboratories may often indicate the type of treatment required but these should be more fully checked in the field, before money is expended on a complete installation. Treatment is often as expensive as from 10c to 30c per 1000 gallons. D. S. HARTSHORN, JR.

NEW PATENTS—483,988, **"Coating Metals".** *The Metal Industry*, London, England. Volume **LIII**, No. 17, October 21, 1938. Aluminium Protection Co., Ltd., Henley, V. F. F., and Wernick, S. A non-reflecting finish is formed on surfaces of aluminium and aluminium alloys, e.g., articles such as fog lamps, photographic apparatus, and aircraft propellers, by eroding the surface to give it a matted finish, e.g., by sandblasting, subjecting it to anodic oxidation in a bath of dilute inorganic acid, e.g., sulphuric acid, substantially free from metallic salts until a thick coating is obtained, and then dyeing the coating black. The Provisional Specification is not limited to anodic oxidation and states that the anoding may be effected by scratchbrushing and that the dyeing step is not essential but may be used to color the coating maroon, black, or other suitable color. Specification 455,412 is referred.
ROBERT B. GOODSELL.

The Crystalline Structure of Electrolytic (Copper) Deposits. IV. By PIERRE JACQUET. *Rev. mët.* **35**, 116-30 (1938); *Chemical Abstracts* **32**, 7348 (1938). The effects on copper plating with various times and current densities of various methods of preparing and polishing the copper cathodes were studied with the microscope. Deposition starts on certain active areas which are described, and at low densities the deposit is not uniform. A theoretical study. ERNEST H. LYONS, JR.

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Electrodeposition of Copper-Nickel Alloys. By J. KRZYZANOWSKI and A. GUREWICZ. *Przemysl Chem.* **21,** 208-13 (1937). Bright adherent coatings of 1:9 copper-nickel alloy are obtained from a bath containing $CuCl.3CS(NH_2)_2$ 5.8, $NiSO_4.7H_2O$ 10, $CS(NH_2)_2$ 90, and AcOH (acetic acid) 20 g/l. at not less than 40°C., with a c.d. of 0.5 amps/sq.dm.—*British Chemical and Physiological Abstracts*; *Chemical Abstracts* **32,** 7348 (1938).

Chromium-plating of Cast Iron. By I. YA. KLINOV. *Vestnik Metalloprom*, **1938**, No. 1, 74-83; *Chemical Abstracts* **32**, 7348 (1938). Samples of three cast irons were plated in a standard CrO_3-H_2SO_4 bath at various c.d. and temperatures for 1.5 hours. Best conditions were 325 amps/sq.ft. at 113°F. Best preparation for plating was mechanical polishing.

ERNEST H. LYONS, JR.

The Isolation of Surfaces Not to be Hardened During Case-hardening by the Use of a Galvanic Deposit. By G. ELSSNER. *Durferrit-Mitt.* **5**, 69-96 (1936); *Chem. Zentr.* **1937**, **1**, 415. For the protection of certain areas from hardening in the case of certain articles to be treated in a salt bath, the use of an electrodeposited combined Ni-Cu protective coating is recommended. The production of this alloy deposit is described and the advantages and disadvantages of the methods are considered M. G. MOORE—*Chemical Abstracts* **32**, 6954 (1938).

Electrolytic Zinc Plating of Fine Objects. By YA. L. VERTSMAN. *J. Applied Chem.* (U.S.S.R.) **11**, 604-19 (1938). Good throwing power of Zn was obtained in the rotating (5 r.p.m.) drum suspended in a bath: ZnO 43, NaCN 120, NaOH 30, sulfonated castor oil 5 g/l. at a c.d. of 5-10 amps/sq.in. at 40°C. and pH of 12.5-13.5. Treating of Zn-plated objects with 10% H CrO for 10 sec. or with 10% of K Cr O for 25-30 sec. stabilized the plating against corrosion. In the presence of Hg in the electrolytic bath, the c.d. should not be higher than 5 amp/sq.in. if a rotating drum is used. Intricately shaped articles should not be Zn plated in an acid bath or in a stationary bath. Twenty-two references. A. A. PODGORNY—*Chemical Abstracts* **32**, 6954 (1938).

Chromium Plating from Chromic Acid-Free Solutions with Chromium Anodes. By M. SCHLÖTTER. *Sheet Metal Ind.* **11**, 721-2 (1937). Cr anodes in rod or bar form were prepared by fusing Al-reduced Cr_2O_3 or electrolytic Cr in magnesite crucibles heated in a high vacuum in a high-frequency furnace. By using an a.c. superimposed on d.c. Cr could be dissolved as Cr^{111} chloride or sulfate. By altering the c.d. or the pH, either brilliant or gray deposits were obtained. The throwing power was comparable with that obtained with complex salt solutions, but, in general, was no better than that obtained from CrO_3 baths.—*British Chemical and Physiological Abstracts*; *Chemical Abstracts* **32**, 7349 (1938).

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